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ABSTRACT

To contribute to a deeper understanding of distance education and its potential development, this 19-chapter book systematically relates correspondence education to seven teaching models: Skinner's behavior control model, Rothkopf's model for written instruction, Ausubel's advance organizer model, Egan's structural communication model, Bruner's discovery learning model, Rogers' model for facilitation of learning, and Gagne's general teaching model. Following two introductory chapters covering background, aim, and teaching models, each of the seven models is discussed in depth. Each model is first described, with an explanation of its view of learning and teaching. Then, specific ways in which the model could be applied to correspondence education are examined. A summary chapter discusses the possibility of applying the models to correspondence education, suggests factors to be considered when choosing and applying models, and describes possible functions of postal two-way communication. An 8-page reference list is included. (Author/LMM)

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CORRESPONDENCE EDUCATION IN THE LIGHT OF A NUMBER OF CONTEMPORARY TEACHING MODELS

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PREFACE

This study is a revised and translated version of a report from the research project »Two-way communication in correspondence education» (BÅÅTH, 1978a). Its approach is fairly theoretical. Its aim is to shed light on the practice of correspondence education by means of a number of contemporary teaching models.

Some of the limitations of the present work are quite deliberate. One of these limitations is that all of the selected teaching models are – more or less explicitly – *psychologically* orientated.

Certainly psychological theories and findings can be relevant to educational research. It is however none the less evident that planning, process and evaluation of teaching are also influenced by non-psychological factors, e.g., social, economic and political. Therefore, an analysis of correspondence education by means of explicitly sociologically orientated (etc) teaching models would be quite conceivable. However, the present study does not deal with models of this type.

Another deliberate limitation is that all of the selected psychologically orientated teaching models are *normative*. They prescribe how teaching should be designed, in contrast to models which only describe teaching in terms of actual performance. The reason for this choice is a wish to concentrate on models which could have an immediate practical value to correspondence educators.

I sincerely hope that this work, in spite of its limitations, will be of some interest to all who are seriously involved – as practicians or researchers – in correspondence education or in distance education on the whole.

> »There is nothing as practical as a good theory» (Kurt Lewin). There is nothing as practical as a good model. (RASBORG ET AL., 1971, p. 91)

It would be most satisfying if, in addition, my attempt could inspire someone else to shed light on correspondence education from other points of departure than those which have been chosen here.

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1 Background and aim

1.1 The lack of theoretical work on correspondence education

In an organized form, correspondence education has existed for more than 100 years. It has nowadays a considerable spread. Nevertheless, educational research has, up to now, devoted only a very modest interest to this kind of teaching (BÅÅTH, FLINCK & WÅNGDAHL, 1978).

As a consequence, few theoretical contributions have hitherto been made to correspondence education. Some exceptions were dealt with in BÅÅTH (1976b), viz. the approaches of Graff, Peters, Moore and Delling. GRAFF (1965) characterized correspondence education as »directed and controlled self-teaching». MOORE (1973, 1975, 1976, 1977) has linked up with ideas in works by WEDEMEYER (e.g., 1971, 1973) on correspondence education as a kind of »independent study». He has developed step by step a theory of independent study and distance education with »autonomy» and »distance» as the main dimensions. PETERS (1971b, 1973) has chosen another point of departure. He has made a particularly thorough study of correspondence education as an »industrialized» process, but he has also, successfully, interpreted it in terms of educational technology. In addition, he has made a most interesting attempt to illuminate correspondence education from a sociological point of view.

Furthermore, mention can be made of the »criteria for use of correspondence education» compiled by NILSEN (1974), as well as the applications of general didactic principles to correspondence education made by LAUTENSCHLÄGER (1971) and LAMPIKOSKI & MANTERE (1976), and the theory of correspondence education as »guided didactic conversation» which HOLMBERG (1977) has presented. A valuable survey of theoretical approaches to correspondence education has recently been presented by HOLMBERG (1978).

Still, on the whole there have been few attempts at systematically relating correspondence education to contemporary educational theories, models or approaches.

In 1962 CHILDS (1971) wrote, having in mind the lack of theoretical studies of correspondence education at that time:

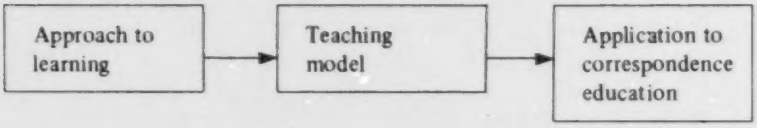
> . . . someone would perform a very great service indeed if he would undertake in a very serious and thoughtful way to relate the generally accepted principles of learning to the process of teaching by correspondence study. (CHILDS, 1971, p. 118)

The situation is somewhat better today than it was when Childs made his statement, due to the various studies to which we have previously referred. Nevertheless, there would still appear to be a considerable need for theoretical interpretations of correspondence education.

When making a new theoretical attempt to shed light on correspondence

education, it would probably be less advisable to refer directly to *learning* theory or to principles of *learning* psychology (cf. the quotation from Childs), since there is a considerable gap between learning theory and the design of teaching. From learning theory/learning psychology it does not immediately follow how teaching should be designed (GAGE, 1963; HILGARD, 1964a). In this study an attempt is instead made to analyze correspondence education by means of a number of contemporary *teaching* models.

However, each of the selected teaching models is in turn more or less closely related to a particular learning theory or view of learning. Therefore, the relationship between approach to learning, teaching model, and application to correspondence education will be as follows:



1.2 Correspondence education in practice – a short survey

Readers who may not be acquainted with correspondence education will be given a short summary of its general features in the following two pages. For a more comprehensive presentation, those readers are referred to handbooks on the subject, e.g. ERDOS (1967, 1975a) and HOLMBERG (1974, 1977). BÅATH, FLINCK & WÅNGDAHL (1978) contains, i.a., an extensive survey of literature dealing with correspondence education.

Correspondence education is a variety of *distance education*. It is distinguished by »... two-way distant communication between teacher and learner by means of stored information» (NILSEN, 1974, p. 54).

Normally, special *teaching material*, intended for self-studies, is used. It may consist of a textbook with an accompanying study-guide containing directions, encouraging comments, explanations, exercises or problems and solutions. Alternatively, it is designed as self-contained correspondence course material in which the parts providing information are wholly integrated with the study guidance parts. As a rule, integrated teaching material of this kind is more personal and the text is fuller than in a textbook.

The teaching material is divided into *study units*, which are concluded by *assignments for submission*. The assignment questions may be of different kinds, e.g. essay exercises and multiple choice questions. They may aim at control of factual knowledge, understanding or application of knowledge, sometimes also at activating higher-level cognitive functions like analysis, synthesis and evaluation. In most cases, the major purpose of assignments for submission is diagnostic-formative.

Solutions of assignments for submission are sent by the student to the correspondence school, which in turn forwards them to a *correspondence tutor* who checks them, gives explanations as well as other comments and (as a rule) also a grade. The extent and design of the tutor's comments may vary considerably between schools, subjects and tutors. Sometimes the comments

assume the form of a personal letter. As a rule, however, they are more neutral in tone and less extensive (cf. HARRIS, 1975).

The student may, in his turn, put written questions to the tutor, make comments on the tutor's corrections, etc. The assignments for submission thus give rise to *postal two-way communication*.

From this short survey it may already be clear that the correspondence student actually has two teachers: on the one hand the *course writer* (supported by the course editor) who has »built in» his teaching into the course material, on the other hand the *correspondence tutor*. At »combined teaching» (i.e. correspondence teaching combined with oral sessions) the student in addition meets an oral teacher who is, most often, not identical with any of the other two. Normally, the correspondence student also gets into contact with the *study councellors* of the school – through its study handbook and, in many cases, by means of individual letters or consultations before the choice of course, as well as sometimes during ongoing studies.

Correspondence education is in certain cases used in teaching adolescents and even children, but is, as a rule, intended for *adults*.

Like most other kinds of adult study, correspondence study is normally a voluntary commitment as far as the student is concerned. The studies are frequently pursued parallel with part-time or (normally) full-time work, or work at home.

Many institutions providing teaching by correspondence are private enterprises or foundations, while others are owned by trade unions, study organizations etc. Still others are departments at universities or are in other ways carried on by the community at large.

1.3 The aim of this study

In the present work, an attempt is made to shed light on the phenomenon of correspondence education by means of a number of contemporary teaching models. The aim is to contribute to a deeper understanding of both what correspondence education *is* and how it *could be developed*. In other words, the purpose might be stated like this:

(1) first of all, to inquire whether the teaching models chosen can be applied to correspondence education

(2) if such an application turns out to be possible, to try to analyse correspondence education from each model

(3) to study how correspondence education for different kinds of learning objectives or learning content could be developed starting from each specific teaching model.

As it is at present practised, correspondence education is by no means a completely uniform phenomenon (BÅÅTH, 1976b; BÅÅTH & WÅNGDAHL, 1976) – no more than the work in all study circles is carried on uniformly (BYSTRÖM, 1976) or the teaching in one classroom is, in all respects, similar to that in another. Therefore, the latter two objectives (2 and 3) stated above cannot be strictly kept apart. Thus, what may appear to one correspondence school as a suggestion for development, may equally well be interpreted as a

description of current activities by another correspondence teaching institution.

When applying the teaching models, consideration will be given not only to the traditional postal two-way communication but also to *existing and possible forms of two-way communication with simultaneous contacts* between teachers/tutors and students, as well as between students, *combined with correspondence teaching*. The following forms are dealt with, in those cases where the models seem to make them appropriate:

- *computer-assisted distance teaching on line*, i.e., computer-assisted distance teaching where the student is in direct contact with a computer; computer-assisted distance teaching *off* line, e.g., the CADE system (BÅÅTH & MÅNSSON, 1977) does *not* imply such direct contact
- *telephone teaching*, mainly of the »telephone tutoring» kind (i.e., guidance of individual distant students) but also, in certain cases, of the »telelecture» type – teaching one or several groups of students simultaneously over the telephone (FLINCK, 1975a; 1978)
- *face-to-face contacts* of various kinds, e.g., by individual tuition, study circles or seminars (WÅNGDAHL, 1977).

Another possible form of combination, which might appear interesting: correspondence teaching + *teaching through radio or TV*, is not dealt with in the present study. The broadcasting media normally allow only one-way communication – from the teacher to the student. It was felt desirable to restrict the number of additional media dealt with in this work to those which make simultaneous two-way communication possible.

2 Teaching models

2.1 The term »teaching model«

»Model« is a word which has many different meanings, not least in scientific contexts (SNOW, 1973). Nevertheless, its basic meaning, which may be expressed in terms of, e.g., »simplified description of a complex phenomenon«, can be traced behind all specific uses of the term (see, e.g., BRODBECK, 1963; SIEGEL, 1967; RASBORG ET AL., 1971; NUTHALL & SNOOK, 1973; ØSTLYNGEN, 1977b).

In this study, the term *teaching model* will be used with reference to various attempts not only to *de*scribe how teaching is (sometimes) actually carried on, but also – and above all – broadly to *pre*scribe how good teaching should be designed. (Cf. the use of the term »theory of instruction« in BRUNER, 1966, p. 40.) Purely descriptive models will thus not be dealt with. The manner in which the term »teaching model« will be used here agrees in essential respects with the approach of JOYCE & WEIL (1972):

> . . . we suggest that there are many kinds of »good« teaching . . . there are many possible courses of action. A model for teaching, as we use the term, is a pattern or plan, which can be used to shape a curriculum or course, to select instructional material, and to guide a teacher's actions.
>
> – – –
>
> When an educator possesses identifiable focuses [on certain aspects of teaching] and a frame of reference which rationalizes them, we can then say that he has a model for teaching.
>
> – – –
>
> Teaching should be conceived as the creation of an environment composed of interdependent parts. Contents, skills, instructional roles, social relationships, types of activities, physical facilities, and their use add up to an environmental system whose parts interact with each other to constrain the behaviour of all participants, teachers as well as students. . . . Models for teaching are models for creating environments – they provide rough specifications which can be used to design and actualize learning environments. (JOYCE & WEIL, 1972, p. 3, 5, and 25)

Joyce & Weil warn their readers of dogmatically clinging to one single »pattern«, one single »plan« of teaching. They recommend teachers instead to consider and, if they like, test several different models. This is well in line with the warning of MATHIS & MC GAGHIE (1974) against the belief that any single theoretical view of learning and teaching could be considered authoritative.

Joyce & Weil regard teaching models as »rough specifications« of various designs of learning environments. Each such model is characterized by a focus

on certain aspects of teaching and by its providing a frame of reference – obtained from, e.g., learning or personality psychology – which rationalizes the particular focuses of the model.

In the following chapters a number of different teaching models will be presented and – as far as possible – applied to correspondence education. The presentation will, in certain respects, follow the pattern which JOYCE & WEIL (1972) have utilized themselves. Thus, for each model its *background* in learning theory, personality psychology etc. will be outlined. The *focus* of the model – i.e. those goals and means which are particularly emphasized – will be described. In this connection model-typical *teacher and student activities* will be mentioned, as well as the degree of *control* of the students' activities that is implied by the model, and – when applicable – the demands on special resources that are made by the model. In addition the *application area* of the model will be briefly discussed, particularly with respect to different kinds of learning objectives. In certain cases *empirical research*, stimulated and/or referred to by the model, will also be indicated.

2.2 The choice of teaching models

The following models will be dealt with:

- Skinner's behaviour control model
- Rothkopf's model for written instruction
- Ausubel's advance organizer model
- Egan's structural communication model
- Bruner's discovery learning model
- Rogers model for »facilitation of learning»
- Gagné's general teaching model.

The following guidelines have been adopted in choosing these models:

1 In the first place, models which had become clearly important to teaching practice and/or educational research – or for any other reason had become well-known – should be chosen.

2 The choice of models ought not to be restricted to those which, on a cursory inspection, seem to be well-suited to correspondence teaching, but should also include models which appear more difficult to apply.

3 Together, the models ought to cover a rather broad spectrum of contemporary views on learning and on how teaching should be designed.

The *first* criterion is probably fulfilled by all the selected models except Egan's structural communication model. This has been included mainly because it claims to further the development of cognitive strategies and similar learning objectives on a high cognitive level, at the same time as it appears – at least on a cursory examination – well-suited to correspondence education.

Since correspondence teaching is normally mediated through the written word, Rothkopf's model for written instruction seems also to be directly

applicable in this connection. The *second* criterion regarding models which, on the contrary, appear difficult to utilize for correspondence education, is met by – above all – Rogers model for »facilitation of learning», and perhaps also by Bruner's discovery learning model.

Regarding the *third* criterion, the majority of the models chosen represent various theoretical approaches to *learning*, from Skinner's extreme behaviourism to Bruner's strict cognitivism. See *box 1*!

Box 1. The models chosen: their theoretical conceptions of learning, as well as their views on the control of the students' learning exerted by the teaching

Model	Conception of learning	Conception of teaching
Skinner's	Extreme behaviourism	Very strict control
Rothkopf's	Moderate behaviourism	Rather strict control
Ausubel's	Moderate cognitivism	Rather strict control
Egan's	Pronounced cognitivism	Moderate control
Bruner's	Strict cognitivism	Mild control
Rogers	Strict cognitivism, connected with a basic theory of personality	»Freedom to learn»
Gagné's	Tries to integrate ideas from most of the other models into his own	

Like Gagné, Rothkopf has some of his roots in the American behaviouristic tradition and has formerly done research on programmed teaching in its Skinnerean form. Both have, however, found the pure stimulus-response models too narrow and have incorporated organism variables into their own conceptions of learning.

Ausubel and Bruner represent the contemporary cognitivistic views, according to which stimulus and response variables are of clearly less interest than the processing of stimuli by the organism itself. The difference between Ausubel and Bruner consists, among other things, in the latter's emphasis on the individual's active striving for knowledge which makes him consider discovery learning teaching methods particularly valuable, while Ausubel mainly deals with »reception learning». In doing so he pretends that expository teaching can further meaningful learning at least as well as teaching directed at the students' own discovery of concepts and principles.

Egan's »structural communication» model is also orientated towards cognitivism, chiefly in its Brunerian version. The most clearly distinguishing feature of this model is its specific technique for programmed instruction.

Rogers model is based on personality psychology; his view of learning is however rather close to Bruner's cognitivism.

The sequence of the models to be dealt with in chapters 3–14 (Skinner's to Rogers) may also reflect different views concerning the *control* of the students' learning. (Cf. *box 1*!) Skinner advocates a very strict control of the

learning conditions, while the subsequent models gradually allow the students' own activities to play a greater role. In Rogers model the student is placed firmly in the centre. Here, the teacher's role is mainly to facilitate such learning activities that are undertaken on the student's own initiative.

In his teaching model, which is claimed to be a general one, Gagné has tried to incorporate ideas not only from Skinner and Rothkopf, but also from Ausubel and Bruner. At least Skinner's, Rothkopf's, and Ausubel's models appear clearly compatible with that of Gagné. The models of Bruner and Egan could probably also be interpreted in Gagné terms. All these more specific models may be said to form certain parts of Gagné's general model. It might not even be impossible to fit Rogers model into the general framework provided by Gagné.

For these reasons Gagné's model will be treated after the other models and, in addition, be given slightly more space.

3 Skinner's behaviour control model

3.1 Introduction

NUTHALL & SNOOK (1973) use the term »the behavior-control model» to denote that view of teaching which is based on behaviouristic learning psychology and, in particular, on Skinner's approach. The following survey will mainly deal with Skinner and his model.

Skinner is a *behaviourist*. He accepts Watson's fundamental thesis that psychologists should concern themselves only with observable behaviour. To attain results, psychology must imitate the natural sciences and be contented with studying what is possible directly to observe and measure. In that way an effective »technology of behaviour» can be created. As a matter of fact, such a technology of behaviour is – according to Skinner – our only hope of rescue from the global catastrophe which he thinks we are approaching (SKINNER, 1971, p. 5).

The corner-stone of the Skinner behaviour control model has been taken, not from Watson, but from another of the outstanding figures of behaviourism – Thorndike. His »Law of Effect» has been reformulated by Skinner into the latter's principles of operant conditioning (SKINNER, 1968, pp. 61–62).

Skinner may be said to be the real originator of programmed instruction as well of teaching technology. After his approach to teaching had been met by an enormous enthusiasm during the fifties and sixties and had given rise to considerable quantities of research and development work, interest in it began to cool round 1970. Skinnerianism and behaviourism soon became dirty words almost everywhere. Nevertheless, the approach still seems to hold a comparatively strong position in American pedagogy. E.g., in an authoritative American textbook from the mid-seventies, operant conditioning is characterized as an extremely practical theory (GAGE & BERLINER, 1975, p. 107). And in other countries, signs of a deeper understanding of Skinner and his view of learning can be traced (e.g., BOHLIN & ÖHMAN, 1975).

3.2 View of learning

Skinner considers that learning is identical with *acquiring behaviour*. Most behaviouristic learning theorists pay great attention to what happens prior to behaviour. The important task is to identify the particular stimulus or combination of stimuli which releases the response. With Skinner, the emphasis is rather on what happens *after* a response. What a person learns is the *consequences* of his behaviour. The consequences are provided by the person's environment. In this way, the environment is given a role as concerns the individual's behaviour which resembles the importance of the environment to the origin of biological species and their evolution by means of natural selection:

> The environment not only prods or lashes, it *selects*. Its role is similar to that in natural selection, though on a different time scale . . . It is

now clear that we must take into account what the environment does to an organism not only before but after it responds. Behavior is shaped and maintained by its consequences. (SKINNER, 1971, p. 18)

Consequences which affect (later) behaviour are called *reinforcements* by Skinner. What is needed to induce »*operant learning*» is (1) an activity, an active behaviour, which is directed towards the individual's environment; (2) a reinforcer, i.e. a stimulus – a consequence – which follows immediately after a behaviour and increases the probability of a recurrence of this pattern of behaviour.

Reinforcements may be positive or negative. *Positive reinforcement* means that an attractive stimulus is introduced as a consequence of behaviour. *Negative reinforcement* implies the ceasing of an unpleasant stimulus as a consequence of behaviour. The removal of an attractive stimulus or introduction of an unpleasant stimulus is denoted by the term *punishment*. See *figure 1*!

		Attractiveness of event	
		Positive	Negative
Stimulus event	ON	Positive reinforcement	Punishment type I
	OFF	Punishment type II	Negative reinforcement

Figure 1. Different kinds of consequences of behaviour: reinforcements and punishments. From GAGE & BERLINER (1975, p. 108)

Skinner is mainly interested in reinforcements of the positive type. Punishments should, according to Skinner, be totally avoided.

Although Skinner places the emphasis of a learning event on what happens *after* a response – i.e., on the consequences of behaviour – he also pays attention to those stimulus situations which elicit the behaviour. By differentiation of the stimuli in such a way that reinforcements of behaviour are provided in connection with certain stimuli but not with others, the behaviour can be put under *stimulus control*.

It is possible to attain a considerably widened behavioural repertoire from an organism by a method called *shaping*. The desired terminal behaviour is divided into components which the organism has to learn successively. Each small approximation of the final behaviour is reinforced immediately. Step by step the requirements are made greater, so that finally the organism must display the complete behaviour to obtain reinforcement.

According to Skinner, his principles of operant behaviour are of general validity. »Verbal behaviour» (SKINNER, 1957) – i.e., language – is learned in this way, as well as behaviours of a still more complex type: problem solving, creative thinking, etc.

3.3 View of teaching

Skinner's view of teaching is closely connected with his view of learning:

> The application of operant conditioning to education is simple and direct. Teaching is the arrangement of contingencies of reinforcement under which students learn. They learn without teaching in their natural environments, but teachers arrange special contingencies which expedite learning, hastening the appearance of behavior which would otherwise be acquired slowly or making sure of the appearance of behavior which might otherwise never occur. (SKINNER, 1968, pp. 64–65)

Thus, to teach is *to arrange such conditions*, or »contingencies», *of reinforcement that make effective learning possible.*

3.3.1 Teaching: the pitfalls

From Skinner's basic view of teaching follows that he is critical of many things both in the world of schools and in educational research.

The traditional control exerted by schools in the form of punishments – formerly corporeal to a great extent, now mainly mental – is wholly condemned by Skinner. It leads to a great many undesirable by-products and is, in the long run, ineffective from an educational point of view (SKINNER, 1968, pp. 21–22, 84–89). But lack of control, as is recommended by certain representatives of »open learning» and other similar educational ideologies, is not satisfactory either:

> It is not enough simply to abandon aversive measures. A Summerhill ... is therapeutic not educational: by witholding punishment teachers may help students who have been badly treated elsewhere and prepare them to be taught, but something else is needed. (SKINNER, 1968, p. 102)

Is enthusiasm in connection with knowledge of and interest in the subject matter enough to be a good teacher? No, SKINNER (1969, p. 25) thinks. »Knowing how to teach» is also necessary – i.e., knowledge of how behaviour is shaped by means of positive reinforcements.

Therefore, principles of Gestalt psychology and Bruner's emphasis on the »structure» of subject matter are also incapable of facilitating the students' learning:

> Proposals for improving education by reorganizing what is to be learned usually contain an implicit assumption that students will automatically perceive and remember anything which has »good form» – a doctrine probably traceable to Gestalt psychology. Current revisions of high school curricula often seem to lean heavily on the belief that if what the student is to be taught has been »structured», he cannot help understanding and remembering it (Bruner, 1960). ... But a high school presentation acceptable to a current physicist is no more easily taught or easily remembered than the out-of-date and erroneous material to be found in texts of a decade or more ago. ... No matter how well structured a subject may be, it must still be taught. (SKINNER, 1969, p. 25)

3.3.2 What is required to bring about effective teaching?

The teacher's role is to arrange those conditions of reinforcement which result in effective learning. Teaching means to lead students from their initial behavioural repertoire (i.e., what they know and are capable to do at the beginning) to the learning objectives.

Therefore, the teacher must

1 *define the objectives* (if they are not already decided on). This means as exactly as possible to describe the desirable terminal behaviour of the students (SKINNER, 1968, pp. 199–206; cf. MAGER, 1962)

2 *identify effective reinforcers*, suitable to his students. Traditionally, this task would have been worded »find suitable methods to motivate his students», or the like. Skinner reduces however *motivation* to a question of reinforcements (ib., pp. 145–168)

3 *observe* each student's *initial behaviour*

4 *elicit* such *responses* from each student that constitute steps on his way from initial to terminal behaviour. This may in certain cases be accomplished by the teacher's demonstration of what the student should do, or, in other cases, by means of verbal instructions (ib., pp. 206–214)

5 *immediately reinforce* performances which approximate to the desirable terminal behaviour and, while doing so, gradually increase the requirements for obtaining reinforcement

6 , by the end of a teaching unit, *evaluate* the students' performances in order to decide whether the objectives have been attained. If this is not the case, prolonged teaching is required until all students exhibit the desirable terminal behaviour.

Evidently, these implications of Skinner's model make heavy demands on a classroom teacher. Without support, the teacher would hardly be able to fulfil them:

> The simple fact is that, as a mere reinforcing mechanism, the teacher is out of date. This would be true even if a single teacher devoted all her time to a single child, but her inadequacy is multiplied manyfold when she must serve as a reinforcing device to many children at once. If the teacher is to take advantage of recent advances in the study of learning, she must have the help of mechanical devices.
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> . . . in the present state of our knowledge of educational practices scheduling appears to be most effectively arranged through the design of the material to be learned. By making each successive step as small as possible, the frequency of reinforcement can be raised to a maximum . . . (SKINNER, 1968, pp. 22, 21)

Thus, according to Skinner, the help can be found in *programmed instructional material*, administrated by means of teaching machines.

3.3.3 Programmed instruction

A teaching programme of Skinner type may be regarded as an application of the principles of behaviour shaping. The subject matter is carefully divided

into small steps, which successively lead to the learning goal. During each step some kind of behaviour is elicited from the student – an answer to a question, e.g. – which is immediately reinforced. At the beginning, numerous cues or »prompts» are provided, as well as incessant reinforcements of each answer which approximates to the terminal behaviour. Later on, help is faded out, and increasingly complex answers are required in order to obtain reinforcement.

Skinner recommends *small steps* – very brief information or training items – for two reasons. Firstly, this enables immediate reinforcement of practically every correct answer. Secondly, the learning steps may be kept at a simple level which minimizes the risk of wrong answers – and consequently, failure or »punishment».

As a rule, a student works on his own through a programme. Skinner recommends that the student *writes his answers* or, in some other way, displays his behaviour overtly. For this reason he is sceptical of multiple-choice questions. In addition he thinks that the distractors (the wrong answer suggestions) to a multiple-choice question act as inadvertent cues or prompts (SKINNER, 1968, pp. 216–217).

The *reinforcements* in a teaching programme normally consist of informing the student about the correct answer – i.e., as a rule, the student is told that he was right. On the whole, this is the best form of arranged reinforcements, according to Skinner (ib., pp. 148–152).

All learning matter can – and should – be programmed, Skinner maintains. The traditional way of reinforcing only end-products when training, e.g., essay writing or problem solving is absolutely rejected. It is like throwing the child in the pool, rewarding it if it manages to swim on its own (ib., pp. 115–119, 131–134). What is important here, as in other areas of learning, is to reinforce, step by step, performances which approximate to the desired terminal behaviour.

3.3.4 Teaching as a technology

Skinner's teaching model implies a *most careful planning* of the teaching in accordance with the principles of operant learning. Each part of the teaching ought to *be controlled* in detail. In this way it will also be possible – for the first time in history, Skinner thinks – to offer *effective teaching*.

Such effective behaviour control need not at all lead to uniformity or »regimentation» (SKINNER, 1968, pp. 90–91). All depends on how the technology is utilized. Skinner, on his part, recommends *individualization* – not only of speed, but also with regard to different students' aptitudes, interests, ways of thinking, etc. According to Skinner, the type of teaching technology that he advocates is particularly suited to an individualization approach. By appropriate reinforcements it is even possible to help people develop individuality and originality (ib., p. 184).

3.4 Research related to the behaviour control model

The empirical basis of Skinner's teaching model consists mainly of results from experiments with rats and pigeons, experiments of which the greater part has

been carried out by Skinner himself and his collaborators. His attempts to apply the principles from these experiments to human learning and teaching have in turn given rise to most extensive research activities in various parts of the world.

In the bulk of the experimental studies, the effects of programmed instruction have been compared with those of conventional classroom teaching. In a great number of these studies no significant differences have been found. In others, one or the other of the teaching forms have appeared most effective (NUTHALL & SNOOK, 1973). This lack of agreement between the experimental results has, however, stimulated another type of experimental research studies that concentrates on specific aspects of the learning and teaching process. Among problem areas investigated, the following may be mentioned: learning objectives, student responses, reinforcements, and evaluation of teaching (see, e.g., ANDERSON ET AL., 1969).

Skinner himself has adopted a fairly sceptical attitude to a great deal of this research, which has, as a rule, taken the form of comparisons between groups of students with some kind of final test as the learning criterion (SKINNER, 1969, pp. 30–32). Instead he recommends careful observations of the individual student's behaviour under varied conditions. Thus, Skinner is consistent in his endeavour to transfer the type of laboratory situations in which he has gained his insights into the learning of pigeons and rats, not only to the teaching of human beings but also to the scientific study of such teaching.

Nevertheless, this very endeavour has met with severe criticism. Some researchers have attacked certain dogmas derived from the experiments with animals in Skinner boxes, e.g., the necessity of overt student responses and extraneous reinforcements (COOK, 1969). Others have delivered a more general criticism of the possibility of transferring psychological principles gained in animal research to domains of human learning. Thus, they have attacked Skinner's and other S-R theorists' axiom that principles of operant conditioning – or similar – can explain how human beings learn. Such criticism is faintly outlined by ROTHKOPF (1968) and fully developed in works by cognitivistic researchers like AUSUBEL (1963). A quick-witted formulation in line with this general criticism is delivered by KOESTLER (1967, p. 17):

> Behaviourism . . . has replaced the anthropomorphic fallacy – ascribing to animals human faculties and sentiments – with the opposite fallacy: denying man faculties not found in lower animals; it has substituted for the erstwhile anthropomorphic view of the rat, a ratomorphic view of man. (KOESTLER, 1967, p. 17)

Many educationalists would probably concur in this accusation of »ratomorphism». Nevertheless, the majority of these critics would most likely be prepared to acknowledge that Skinner's teaching model has greatly contributed to the now common insight into the importance of systematic planning of teaching (= educational technology, in the widest sense of this term).

3.5 Summary of the model

Skinner represents a purely *behaviouristic* view of learning. To learn something is to acquire new behaviour. Behaviour is seen exclusively as responses to stimuli in the organism's environment. Internal processes or »intervening variables» are not discussed at all.

According to Skinner's learning model, the consequences of behaviour are of particular importance for what the individual learns. By means of carefully planned *positive reinforcements* the behaviour of an organism can be shaped to an unlimited extent – i.e., as far as the genetic endowment of the species permits. If the reinforcements are given only when the behaviour is displayed in connection with specific stimuli, the behaviour will eventually become conditioned to these stimuli.

To Skinner, teaching means *the arrangement of those reinforcement conditions that make effective learning possible*. This requires (1) carefully defined learning objectives in behavioural terms, (2) identification of effective reinforcers, (3) knowledge of each student's initial behaviour repertoire, (4) eliciting those responses that constitute steps on the path towards the terminal behaviour, (5) immediate reinforcement of approximating responses, and (6) evaluation of the students' performance as compared to the learning objectives.

According to Skinner, optimal reinforcement conditions can hardly be brought about without *programmed teaching materials*, preferably administrated by teaching machines. An orthodox Skinner programme leads the student, by means of very brief learning items and immediate reinforcements of correct answers, step by step from initial to terminal behaviour.

Thus, in Skinner's opinion, the main part of the teaching should be taken care of by programmed teaching materials. These should be characterized by an extremely high degree of structure. Consequently, the behaviour control model of teaching implies a *very strict control* of the students' learning activities. Furthermore, the individualized parts of the teaching are assumed to be strictly programmed.

Skinner seems to be of the opinion that his teaching model is applicable to all kinds of teaching, irrespective of content, aim or level. Nevertheless, it is probably of greater use in the domain of motor skills than in that of cognitive learning tasks. Moreover, within the cognitive domain, the more skill-related areas are probably better fitted to a Skinnerean interpretation than others:

> The applicability is best in vocational training, where very exact terminal behaviours can be defined, but may also be good in certain more general subjects, e.g., mathematics and statistics. (NORDQUIST, 1973, p. 67)

Many people who have accepted Skinner's behaviour control model on the whole, have nevertheless deviated from it in one or more of the details. Among the most common deviations of the *more liberal varieties of the model*, the following may be mentioned:

- teaching programmes in the form of books or booklets (i.e., *not* administered by *teaching machines*)
- *longer learning steps* than those extremely short recommended by Skinner
- programmes which allow the student's responses *not* (always) to be *overt*, i.e., observable
- programmes which do *not* (always) reinforce the student's responses explicitly.

4 Skinner's model applied to correspondence education

4.1 Is it fundamentally possible to apply the model to correspondence education?

All forms of distance education imply a comparatively thorough planning of the teaching, since the physical distance involved reduces the opportunity for the kind of improvisations that may take place in, e.g., classroom teaching. In this respect, correspondence education may be regarded as a prototype of all other forms of distance education. Learning objectives, target groups, subject matter, representation forms, sequence, exercises, evaluation occasions etc. have to be planned and determined in advance, before the teaching proper can be started. They must be »objectivated» (DOHMEN, 1970) in the form of teaching material and assignments for submission, as well as perhaps in model answers to the assignment questions or in detailed directions to the correspondence tutor.

A conscious educational technology approach to correspondence education is therefore near at hand. As a matter of fact, such approaches have also been made by – among others – HOLMBERG (1969 as well as in several later works, e.g., 1977), PETERS (1973), the Norwegian State Council on Correspondence Education in collaboration with the Association of Norwegian Correspondence Schools (*Brevkursproduksjon i lys av systemtenking*, 1975), ERDOŞ (1975b), and ØSTLYNGEN (1977a).

That correspondence schools normally – consciously or not – apply certain principles of educational technology does of course not mean that correspondence education is, as a rule, designed according to the Skinnerean behaviour control model. During the sixties the relationship between correspondence education and programmed instruction was fairly frequently discussed (e.g., GRAFF, 1964b; SJOGREN, 1964; LARSSON, 1965). According to a questionnaire survey by KEMPFER (1965), several American correspondence schools at that time made use of teaching programmes, while, on the other hand, representatives of certain other correspondence schools maintained that good correspondence teaching *is* actually programmed instruction.

When comparing correspondence education with the Skinner type of programmed instruction, SJOGREN (1964) found the following *similarities*:

S 1 The students are, to a great extent, allowed to study at their own pace

S 2 Normally, the students' own activity is at a high level

S 3 The teaching is comparatively highly structured

S 4 Feedback is given;

but also the following *differences*:

D 1 In programmed instruction stronger emphasis is given to confirming feedback – i.e., the students should normally be lead to giving only correct answers

D 2 In correspondence education, feedback is, as a rule, immediate only in the form of answers to self-test questions and exercises within the teaching material; in relation to the solutions of assignments for submission feedback is considerably delayed.

D 3 In correspondence courses, the learning steps are considerably much longer than in instructional programmes.

HUSÉN (1960) had in fact previously pointed out that the corrections and comments of the correspondence tutor to students' answers cannot be considered as reinforcers in the Skinnerean sense, since they reach a student too long after his response (cf. D 2).

In spite of the differences between correspondence education, as it is normally carried on, and programmed instruction, it appears quite possible to design correspondence teaching according to Skinner's behaviour control model. If so, the postal two-way communication must of course be thought of as having *other* functions than making reinforcement of students' responses possible.

4.2 The design of the teaching material

Correspondence education framed according to the behaviour control model requires precise learning objectives defined in behavioural terms, information about the students' previous knowledge (their »initial behaviour repertoire»), carefully planned and sequenced information/instruction and response steps, arrangements for immediate reinforcements, and possibilities to evaluate the students' achievements with the learning objectives as criteria. In addition, arrangements for individualized learning (not only as concerns study pace) are clearly desirable according to Skinner.

The bulk of the teaching process should obviously be put into the teaching material. Consequently, the study units of the correspondence course ought to be designed as *teaching programmes* with carefully planned and sequenced short steps. Each step should give information and/or instruction, keep the student constantly active by means of questions (or other kinds of exercises) – which should be comparatively easy to answer – and permit immediate positive reinforcement.

We must therefore imagine the correspondence student sitting at home or, e.g., in a library, working through his programmed study units. According to Skinner's orthodox model these should be adapted for use in a *teaching machine*, which the student would have to buy, hire or borrow. Alternatively, the programmes may however be produced as *printed booklets* – like traditional »teaching letters». Another possible form is *audio tapes*, which contain information/instruction, questions, space for the student's own answers, and correct answers.

Other deviations from Skinner's original demands might of course also be made, if one desires to apply a more liberal variety of the behaviour control model. (Concerning deviations from the demands for very short learning steps, overt responses and explicit reinforcements, see 3.5.)

4.3 The functions of two-way communication at a distance

4.3.1 Postal two-way communication

If one applies the behaviour control model to correspondence education the emphasis will obviously be on the teaching material. Some tasks must however be referred to the two-way communication between the student and the correspondence tutor (and/or another representative of the teaching institution). Certainly, it would be possible to leave these tasks in the student's own hands, but if so, one would partly deprive oneself of the control that is one of the foremost distinguishing features of the model.

Among such tasks, applicable to the two-way communication, the following may be mentioned:

- to diagnose each student's previous knowledge and to take appropriate measures on the basis of the results
- to evaluate each student's learning progress and to take appropriate measures if a student's achievements do not correspond to the established objectives
- to provide some other individualization with respect to each student's aptitudes and previous reinforcement patterns (»interests», »ways of thinking», etc.).

The students' previous knowledge can be diagnosed by means of a test. On the basis of the individual result, the correspondence tutor can suggest the programme (the course, as well as the study unit in this course) on which the student could start.

As *evaluation* instruments, the assignments for submission in each study unit may be used. If a student has not succeeded in attaining the objectives of the sudy unit, the correspondence tutor should provide remedial instruction, possibly by sending a pre-produced supplementary programme to the student.

The measures now mentioned, taken with respect to the students' initial and terminal performances, already imply a certain amount of individualization. *Other forms of individualization* with respect to the students' aptitudes and previous reinforcement patterns, desirable according to Skinner's teaching model as it is interpreted here, require deeper knowledge of each student. Such knowledge of the student's interests etc. could be acquired by the tutor at the beginning of the course, by means of a questionnaire, or by asking the student to talk about himself in connection with the assignments for solutions – which, however, presupposes a certain amount of openness also on the tutor's part. In accordance with the application of the model in other respects, the individualization may be brought about by means of a range of programmes suitable to various interest areas, to different needs of explicit reinforcements, etc. Alternatively, the correspondence tutor might work out his own comments to students' solutions in a way which allows for individualization.

Evidently, the main function of assignments for submission in a correspondence course designed according to the behaviour control model would be to make the evaluation of the students' performances possible – i.e., to create

opportunities for controlling their progress. (At the same time they may of course be used for evaluation of the programme.) In addition to such formative evaluation, the assignments for submission should be able to be utilized for certain other forms of individualization, as just discussed.

Still another function of assignments for submission (and, consequently, of the postal two-way communication) is however conceivable. Skinner is anxious to emphasize that teaching is not for the sake of school, but for the sake of life:

> Instructional contingencies are usually contrived and should always be temporary. If instruction is to have any point, the behavior it generates will be taken over and maintained by contingencies in the world at large. The better the teacher, the more important it is that he free the student from the need for instructional help. (SKINNER, 1968, p. 144)

One step on the path towards freeing the students from the specific stimulus situations and reinforcement conditions of the teaching would be to give, after the initial learning, more and more realistic *application exercises*. Such exercises could, of course, be integrated into the teaching programme itself. It would however seem to be appropriate to use some of the assignment questions for exercises of this kind.

4.3.2 Postal two-way communication supplemented by simultaneous contacts

Much computer-assisted teaching on line has been designed as programmed instruction. When applying Skinner's behaviour control model to correspondence education it would therefore appear natural to imagine the postal two-way communication supplemented by **computer-assisted distance education on line**. The model requires however that the computer system allows the student to *write* his answers, since Skinner doubts the value of multiple-choice questions (and the like).

Granted that the economic frames would permit it, even *the entire teaching process* – including test of previous knowledge, teaching programmes, evaluations of the student's achievements with remedial programmes, if any, and individualizing parts referring to interests etc. – could be administered by a computer. In this way, it would be possible to attain an optimal control of the distant learning situation. (If, on the other hand, this kind of teaching could be called correspondence education, might however be questioned.)

It would perhaps be more realistic to conceive media combinations where *certain parts of the teaching* are given by means of programmes in more conventional forms like booklets or audio tapes with assignments for submission, while others – e.g., remedial programmes – are provided by a computer on line.

A still more limited (and maybe still more realistic) use of the computer would be to let it only *evaluate* the students' *assignments for submission* (or, rather, »assignments for dialling the computer»). Thus, in this case the student contacts the computer, via the telephone or computer network, when he has arrived at the end of a study unit (a programme). By means of the input facility available, the student communicates his answers to the computer. The computer, in its turn, gives the student immediate corrections, comments

and instructions via a typewriter terminal or a TV screen. From the Skinnerean perspecitve, there is the obvious advantage of giving immediate reinforcement.

Individual **telephone teaching** of the type telephone tutoring (FLINCK, 1978) could be used to facilitate diagnosis and remedial measures in connection with assignments for submission as well as other individualizing features. If the evaluation of students' solutions of assignments is handed over to the computer (cf. above), the telephone would seem to be the most natural medium for the remaining contacts between student and tutor implied by the behaviour control model.

Face-to-face contacts between tutor and students could facilitate the initial diagnosis of the students' previous knowledge. Such contacts could definitely also further the tutor's knowledge of the students' interests and other distinctive features which the tutor may want to consider when choosing programmes fitted to each individual student. In addition, certain individualizing measures could be taken during the actual face-to-face sessions, particularly if these were designed as individual talks between tutor and student.

Face-to-face contacts (or, possibly, advanced teaching machines) appear necessary for the training of certain *motor skills*.

4.4 Skinner's model applied to correspondence education – a summary review

When applying the behaviour control model to correspondence education, the emphasis will be on the *teaching material*, designed as a series of instructional programmes.

The primary functions of the *two-way communication* will be diagnosing the students' previous knowledge (and taking appropriate measures on the basis of the results), evaluating formatively the students' achievements, and performing some other kinds of individualization. In this way, the main task of the assignments for submission will be in facilitating the control of the attainment of learning objectives.

All these functions of the two-way communication can be fulfilled by traditional *postal contacts* between student and correspondence tutor. The diagnosing and, above all, the individualization can however be facilitated by *telephone tutoring* and – perhaps to a still higher degree – by individual *face-to-face contacts* between tutor and student.

An interesting possibility for the future would be to integrate *computer-assisted distance education on line* into correspondence teaching planned according to the behaviour control model. In the most extreme case, the entire teaching process would be given this way. However, a more realistic possibility would be to have the computer only take over the evaluation of the students' solutions of assignments for »submission».

5 Rothkopf's model for written instruction

5.1 Research related to mathemagenic activities

ROTHKOPF (1970, 1976) has presented what might be conceived as a model for written instruction. The model is built on Rothkopf's and other researchers' studies on »mathemagenic activities». NELSSON (1976) has made a broad survey of this research, while DAHLGREN (1975) and SÄLJÖ (1975), among others, have examined it from certain aspects.

Rothkopf has his theoretical starting-point in the behaviouristic tradition, the basic principles of which he does apparently not question. Nevertheless, he represents a considerably more liberal variety of this tradition than Skinner. Rothkopf deals not only with stimulus and response variables but also with what happens within the human being. Actually, such organism variables or »intervening variables» are considered by Rothkopf clearly important to learning.

Rothkopf likes to quote an old proverbial phrase, which he applies to teaching and learning:

> You can lead a horse to water, but the only water that reaches his stomach is what he drinks. (ROTHKOPF, e.g., 1976, p. 94)

Thus, teaching plays a certain role, but what a student learns is ultimately determined by his own activities. Rothkopf calls such activities *mathemagenic*, i.e., activities »giving birth to» learning (from the Greek *mathemain* = that which is learned, and *gignesthai* = to be born). The following formal definition of the concept has been given:

> ... mathemagenic activities are those student activities that are relevant to the achievement of specified instructional objectives in specified situations or places. (ROTHKOPF, 1970, p. 327)

Research related to mathemagenic activities (MGA) has been concentrated on learning by means of written material and has had an experimental approach. As a rule, the experiments have been of the laboratory type, i.e., well-controlled but – more or less – artificial. Compared with most earlier experimental studies of verbal learning, an advantage of the MGA experiments is their utilization of meaningful, coherent texts. Other features have however been more artificial. For instance, the texts have mostly been rather short (often round 5000 words), and the subjects of the experiments have, as a rule, been allowed to read the texts only once (NELSSON, 1976).

ROTHKOPF (1970) distinguishes three classes of MGA operative when a person is studying written teaching material:

1 *Orientation* (to get into the vicinity of the teaching material)
2 *Object acquisition* (to select and procure appropriate teaching material)
3 *Translation and processing* (in the first place, »translation» of the text to internal representations by means of various mental processes).

Class 1 and 2 activities are directly observable, in contrast to class 3 activities. Nevertheless, the bulk of the research on mathemagenic activities has concerned attempts to influence *class 3 activities* during study of written material.

The experiments have yielded the following often replicated results (NELSSON, 1976; ROTHKOPF, 1976):

(A) Explicit definitions of objectives and/or questions *before* a text facilitate (within certain limits) learning of facts directly related to the objectives or questions. However, detailed questions before a text tend to focus attention narrowly on the »question-relevant« text passages, with the effect that other segments of the text are neglected.

(B) Questions *after* short parts of a text (e.g., about 200 words) give more general positive learning effects. Subjects belonging to the experimental groups learn not only facts directly related to the questions but achieve better than the control group subjects also when tested on »question-irrelevant« information. This is explained by Rothkopf in the following way. During study of new parts of a text, subjects gradually direct their MGA to such kinds of information as have been covered by the questions after previous parts. This adaptation is effected by a type of learning having » . . . some resemblance to instrumental conditioning« (ROTHKOPF, 1971, p. 285).

In addition, a few studies indicate that

- questions on a higher cognitive level (understanding, application) yield higher-quality learning results – probably because such questions make the subjects process the information provided by the text at a higher cognitive level
- subjects' MGA may be affected more strongly if questions are asked in a face-to-face situation by a teacher (or »a teacher-like figure«) than if they are inserted into the text (ROTHKOPF, 1972)
- positive effects of questions after a text passage tend to fade out if subjects already possess a repertoire of MGA relevant to the specific learning situation and/or are highly motivated.

5.2 View of teaching

5.2.1 Texts as nominal stimuli

Although Rothkopf stresses the importance of the students' own processing of a text material, he also pays attention to the texts themselves and their characteristics. In doing so he makes use of a distinction between »nominal« and »effective« stimuli (ROTHKOPF, 1971, 1976). In this connection, the term *nominal stimuli* refers to those written words, sentences etc. which make up the given study material. By the students' MGA the nominal stimuli are translated into *effective stimuli*:

> Learner performance thus is the result of both the nature of the nominal stimulus, that is, the attributes of the text, and of the processing operation by the reader. (ROTHKOPF, 1976, p. 96)

ROTHKOPF (1976) distinguishes three classes of teaching-relevant characteristics of texts as nominal stimuli: content, representation, and form. See *table 1*!

Table 1. Texts as nominal stimuli: attributes related to instructional effectiveness, according to ROTHKOPF (1976, p. 97)

Text attributes	Goal-specific	Population-specific
Content		
Completeness	Yes	Yes
Accuracy	Yes	No
Goal guidance	Yes	No
Unrelated material	Yes	Yes
Representation		
Lexicon	No	Yes
Exposition	No	Probably
Organization	No	Probably
Form		
Grammatical structure	No	Yes
Grammatical complexity	No	Yes

Rothkopf maintains that, from the teaching effectiveness point of view, **content** is the most important class of text attributes. Among content characteristics he mentions (cf. the table!)

- *completeness* (i.e., the extent to which the text covers the knowledge needed to attain a particular instructional goal or objective; cf. the definition of MGA in 5.1)
- *accuracy* (i.e., the accuracy with which the text provides correct information)
- *goal guidance* (i.e., guidance concerning instructional aim, purpose, or objectives of the text)
- *unrelated material* (i.e., the extent to which text material is included which is *not* related to the specific instructional goal the study organizer has in mind).

Texts intended to contain the same minimum content may **represent** this content in different ways. Rothkopf distinguishes three kinds of representation (cf. table 1):

- *lexicon* (= choice of words)
- *exposition* (i.e., instructional metaphors, similes, and defining or referential phrases)
- *organization* and sequencing of the various parts of a text.

By **form** attributes Rothkopf refers to

- the *grammatical structure* of sentences, and
- the *grammatical complexity* of syntactic periods.

Both representation and form attributes appear to be *population-specific*. Thus, the effects of choice of words, grammatical structure etc. most probably varies with different target groups. The same thing refers to certain content characteristics (cf. table 1!). Since students possess varying amounts and levels

of subject matter-related previous knowledge, completeness (above all) necessarily means different things to various target groups. A text which covers a content in a fully adequate manner to students who are already acquainted with closely related subject areas may appear completely inadequate to a novice in the same field.

5.2.2 Teaching by means of written material

ROTHKOPF (1968, 1970) contends that the MGA concept points to a general teaching strategy with emphasis on furthering the students' own activities rather than developing sophisticated instructional material:

> The concept of mathemagenic activities tends to shift emphasis from investment of resources in the development of instructional materials to investment in the instructional environment.
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> – – –
>
> Instructional materials are accepted within some limits as given. Emphasis in instruction is on promoting those activities in the student that will allow him to achieve instructional goals with available materials. . . . How to manage this poses many practical problems but it may be more economical than expensive concentration on the detailed design of instructional material. (ROTHKOPF, 1970, pp. 334–335)

According to Rothkopf, teachers who want to utilize written material thus have, in principle, two alternatives (cf. ROTHKOPF, 1976):

1 to *develop material adapted to the specific purpose and target group of the instruction*. In this case, the text is aimed at covering exactly that content which corresponds to the specific objectives of the teaching (but no more), and it is with reference to choice of words etc. and linguistic form optimally adapted to the target group in question.
2 *to choose that material among available textbooks and other informatory texts* which most closely corresponds to the purpose and target group of the teaching, and *to attach to this material teaching aids aimed at furthering the students' MGA*, i.e., their own work with the text material.

Rothkopf recommends the latter approach. It is of course impossible completely to ignore characteristics of texts as nominal stimuli, above all with reference to content but also as regards choice of words etc. and grammatical form:

> For best results, care should be taken not only that students read to learn but also that text has been written to teach. (ROTHKOPF, 1976, p. 129)

Nevertheless, when the teacher has chosen an acceptable text, it is thus important that he attaches to this material aids which facilitate the students' own work with it. Such instructional aids may contain, first of all,

– guidance how to study the text, e.g., information about the learning goal/objectives
– adjunct goal-relevant questions.

The need for supplementary aids varies with text materials and target groups. Lacking previous knowledge, inappropriate reading habits etc. – as related to the content and linguistic style of the text – make heavy demands on the students' MGA (and, consequently, on supplementary teaching aids):

> ... when experience relevant to acquisition of particular information element is small, more elaborate and less probable levels of mathemagenic activities are required for successful learning results. (ROTHKOPF, 1976, p. 124)

On the other hand, if a target group can be assumed to possess good previous knowledge, as well as a repertoire of MGA appropriate to the design of the text material chosen and/or an initially high level of motivation – if so, there will be no need of too extensive work to be spent on the supplementary teaching aids.

Schematically, Rothkopf's model for written instruction could thus be described this way:

1 Define goal/objectives and analyze the target group's previous knowledge, study experience, motivation, etc.
2 Choose an available text material which, as closely as possible, corresponds to the goal/objectives of the teaching and the target group's qualifications. When making the choice, consider also such text attributes as level of linguistic difficulty, sequencing, etc.
3 Prepare supplementary material in order to adapt the basic text material to the specific goal/objectives and target group of the instruction. In this teaching aid, give directions concerning the use of the text, and inform about the learning goal/objectives. In addition, ask questions, and provide feedback. The questions should be goal-related and intended for use after modestly short text passages.
4 Ensure that the students make real use of both the text material and the supplementary teaching aids. (Cf. what Rothkopf calls class 1 and 2 MGA, 5.1!)

5.3 Summary of the model

Rothkopf's research has its starting-point in the behaviouristic tradition. Nevertheless, he has considerably modified the strictly behaviouristic stimulus-response view of learning by devoting great attention to the students' interior processing of stimuli, an important class of »mathemagenic« activities.

By *mathemagenic activities* (MGA) Rothkopf denotes all student activities relevant to the attainment of specific learning objectives. What he has in mind is primarily the objectives that could be achieved by means of written instruction.

Rothkopf recommends the teacher to choose available textbooks etc. which are reasonably well suited to the learning objectives and the specific target group. A supplementary material, prepared with the aim of facilitating and controlling the students' MGA, should be attached to the main body of material. These supplementary teaching aids may contain directions to the study, including information about the objectives, and goal-relevant questions.

The degree of control is not as high as in programmed instruction of the

Skinnerean type. Despite this, comparatively strictly controlling teaching functions are implied. The teacher defines the learning objectives (or accepts objectives determined by a higher authority), he chooses text material, and he tries to facilitate and control the students' processing of this material.

An interesting feature of Rothkopf's model is that, at least compared with programmed instruction, it requires fairly modest resources.

The model applies primarily to written instruction but is also applicable to combinations of oral and written instruction. It is however based on research of a laboratory type. Therefore it would appear uncertain to what extent the effects demonstrated in the experimental studies can be attained in realistic teaching situations and with other areas of learning objectives than verbal information. Actually, MARTON ET AL. (1977) have criticized the MGA research, as well as the teaching model which can be derived from this research, by maintaining that it applies only to learning at a »surface level». However, as is shown by NELSSON (1976), certain studies have dealt with learning at higher cognitive levels, normally with positive effects.

6 Rothkopf's model applied to correspondence education

6.1 Is it fundamentally possible to apply the model to correspondence education?

Rothkopf's model for written instruction appears to be directly applicable to correspondence education, since correspondence education is – in its pure form – written instruction.

However, as we have seen, the model is to a great extent based on teaching experiments with comparatively short texts, equivalent to, e.g., about ten pages in a printed book. Correspondence courses normally run to at least one hundred, sometimes more than one thousand pages. Therefore, the applicability of the model is perhaps not as evident as it may appear at a first glance.

Nevertheless, the following discussion in this chapter is based on the assumption that Rothkopf's model, despite the reservation above, can be applied to correspondence education.

6.2 The design of the teaching material

In practice, course material for correspondence education is worked out in two different varieties – either as self-contained correspondence course material or as one or more textbooks supplemented by a study-guide for correspondence students (cf. chapter 1.2!). Sometimes these two types are called »independent course» and »commentary course». LJOSA (1975b) who discusses the respective advantages and disadvantages (economic, administrative, educational) of both types, makes the following distinction between them:

> In an independent course the components are mutually integrated, so that the course constitutes one, inseparable unity – »take it or leave it». In a commentary course the basic material may stand alone, for instance as a textbook for use in school or for private study. Only the supplementary component makes it a correspondence course by adding at least some assignments which provide for two-way communication. (LJOSA, 1975b, p. 113)

According to Rothkopf's model, correspondence study organizers should prefer *the combined form* – the »commentary course» type.

Thus, after analyses of goals/objectives, target groups etc., the next step would be to try to find out whether there is (or is expected to be) a textbook in the market – or other suitable material – which could be used as **basic study material** in the planned correspondence course. If two or more possible books or packages are available, their suitability should be evaluated with respect to, firstly, their *content* (completeness, accuracy, etc.) and, secondly, *representation* and *form* (choice of words, sequencing, grammatical complexity, etc.; cf. 5.2.1). In this evaluation, the goals/objectives are of course taken into consideration, as well as what is known or can be assumed concern-

ing the target group's previous knowledge, study experience, etc.

In addition to the basic study material a **study guide** has also to be prepared. This study guide should of course be of the same standard as the basic material. Actually, the text in a study guide may sometimes be more difficult (as measured by means of a readability index) than the basic material, the study of which it is intended to facilitate (BRITTAIN, 1973). This is most unlikely to be a favourable arrangement.

The study guide should contain *directions* regarding how to study the basic material. In addition to various kinds of instructions it ought to inform about the *goals/objectives* – according to Rothkopf's model. In this way the students are helped to concentrate on what the study organizer has considered most essential. In addition, *questions* with feedback can be given fairly often. The questions should, where possible and appropriate, provide scope for a reasonably high level of cognitive processing (understanding, etc.) among the students and – of course – be related to the goals/objectives.

If the content of the basic study material is to some extent imcomplete or incorrect, the study guide must, of course, in addition supply supplementary and correcting information. Correspondingly: if the basic material is poorly organized/sequenced, or is characterized by a difficult choice of words etc., the study guide may also provide help in these respects. However, what should be included in a study guide must always be determined in the light of what is known or assumed about the target group's previous knowledge, study experience and ability to process the basic material on their own – in other words, its repertoire of mathemagenic activities (MGA).

All of the items which have hitherto been mentioned as implications of Rothkopf's teaching model have actually been found – at least to some extent – in study guides to the basic material of correspondence courses. For instance, questions in the form of »self-test exercises» (or the like) are common, even if some correspondence schools do not make use of such exercises at all or utilize them in only a minor number of their courses (BÅÅTH, 1976b).

As we have seen, the empirical research on which the MGA model is based appears to demonstrate that questions *after* a part of the text lead to more generally favourable effects than questions before a text segment. However, in a real-life teaching situation students, as a rule, can first read the question and after that the corresponding text, wherever the questions may be placed in a text. Of course, this also applies to correspondence students. If they want to, they may use the questions of the study guide in a way that is partially different from what would be desirable according to the MGA model. The only possible way in this case seems to be that the study guide tells the students not only *how* the questions should be utilized but also *why*.

So far in this chapter, only class 3 MGA (cf. 5.1) have been dealt with – i.e., the students' own processing of information – and measures aimed at controlling (or at least facilitating) this internal processing. However, in correspondence education the control of *class 1 and 2 MGA* – i.e., »orientation» and »object acquisition» – may also present problems. Even if an individual has been sufficiently motivated to apply for a correspondence course, his situation, when the course material has arrived, may be such that his desire for studying does not occur spontaneously. After having opened the consignment and skimmed through the material, the student might simply leave it, devoting himself to his home, his family, his work, or a hobby instead. A

correspondence student really has »veto power over the success of written instruction» (ROTHKOPF, 1976, p. 94).

The share of non-starters in correspondence education is also considerable. In addition, drop-out is clearly most common in the very first units of a course (PFEIFFER & SABERS, 1970; REKKEDAL, 1972). In order to get the students' MGA going at all, the correspondence school should probably try to make the study material as attractive and well-arranged as possible. (Cf. BÅÅTH, 1974, pp. 71–73.)

6.3 The functions of two-way communication at a distance

6.3.1 Postal two-way communication

Since Rothkopf's model is intended for teaching by means of written study material, it has been comparatively easy to apply the model to the design of course material for correspondence education. Deriving the possible implications for two-way communication appears to be a somewhat more difficult task.

To start with, we may of course note that the *assignments for submission* in correspondence education can be regarded as a kind of questions after the text. In those cases where a correspondence course does not contain any »self-test exercises» at all, the assignments for submission constitute the only questions of the course. It is however – at least nowadays – fairly common that assignments for submission are rather sparsely met with in correspondence courses. Study units vary between about 10 and 100 pages (or more); 50-page study units are far from seldom (BÅÅTH, 1976b). It would therefore appear doubtful that assignments for submission, such as they are used in practice, could play exactly *the same* role as after-text questions in the MGA model.

Despite this, it seems to be highly probable that assignments for submission could have a controlling effect on the students' MGA, in the same way as, in other educational contexts, questions aimed at evaluating learning usually control the learning process (SÄLJÖ, 1975). This effect may be more or less favourable. It is probable that some students start to work on a study unit by reading the assignments for submission, after which they look only for those parts of the text which are related to the assignments. (Like »self-test exercises», the assignments for submission can easily be read *before* the text, if the students prefer to do so; cf. 6.2.) Certain correspondence students appear to devote a disproportionately great share of their study time – 50 % or more – to the assignments for submission (BÅÅTH, 1975, pp. 26, 33). The reason might be that such students, when they are working on a study unit, start with just the assignments for submission and – to a great extent – ignore material not immediately related to these assignments.

Therefore, it appears important that the assignments for submission cover all of the essential objectives of a study unit (or, alternatively, that it is explicitly declared that the assignments do *not* do so) and that they are designed at a sufficiently high cognitive level as to make it impossible to find the correct answers directly in the text. Acquaintance with the entire study material and

a thorough mental processing of the essential parts ought to be a prerequisite of acceptable solutions.

The postal contacts between correspondence tutor and student can probably affect the student's motivation (cf. BÅÅTH & WANGDAHL, 1976) and, thereby, stimulate *class 1 and 2 MGA*. To certain students, this external stimulation may be of great importance considering that correspondence courses are, as a rule, comparably extensive (at least, compared with texts in MGA experiments) and are most often studied on one's own.

Of course, the correspondence tutor should also try to stimulate students' *class 3 MGA* by individualized goal-related measures. The tutor may, e.g., give directions and/or put questions in order to focus students' attention on essential information which they have overlooked or misinterpreted. At least partly, the measures should be of the type »aid to helping oneself». Consequently, they should help the student to develop such MGA that they can eventually learn to process even relatively unstructured information themselves in a way relevant to the purpose of the studying.

6.3.2 Postal two-way communication supplemented by simultaneous contacts

One problem, which we found when we tried to apply Rothkopf's model to »pure» correspondence education, was that questions – »self-test exercises» as well as assignments for submission – could be used *before* reading the corresponding parts of the text instead of *after*. If **computer-assisted distance education on line** is combined with correspondence study, this disadvantage could be reduced, or completely eliminated. As we have seen (4.3.2), the most realistic utilization of the computer from an economic point of view would be to let it assist in connection with the *assignments for submission*. When applying Rothkopf's model the computer should *present* these assignments to the student (e.g., via his TV screen), not only evaluate and comment on his solutions.

It would of course be possible (but more doubtful from an economic point of view) to let the computer also present *»self-test exercises»* and, in addition, evaluate and comment on students' answers to such questions. This would require the students at least once, maybe several times per study hour to contact the computer via a telephone and a TV screen and/or a typewriter terminal.

Another problem which we met when applying Rothkopf's model to traditional correspondence education was the difficulty of *exerting an influence on their class 1 and 2 MGA*. Many students run the risk of not getting their studies started at all. Properly utilized, simultaneous contacts could probably give more effective help in this respect than could be achieved by means of the study material and the postal two-way communication. Telephone contacts in the form of **teletutoring** at the start of the course could very well be used for this purpose.

At most correspondence schools students are allowed to begin a course at any time in the year (BÅÅTH, 1976b). Therefore, in many cases *individual* teletutoring may be the only form possible. Nevertheless, as soon as several students apply for a course at about the same time, it would appear possible

to try *group* teletutoring as well. Certain correspondence students might decline such contacts – just as they could refuse face-to-face contacts in a class or a study circle – but to others group teletutoring could probably counteract any feelings of isolation in the study situation.

Teletutoring, in the individual or group form, can of course be provided not only at the beginning of a course but also on suitable occasions *during the studies*. Continuous directions and questions should constitute obvious parts of such teletutoring. Nevertheless, group teletutoring implies that all students in a tutored group study their course at about the same rate. This is seldom the case with correspondence students, since most correspondence schools allow considerable freedom as concerns duration of the studies (BÅÅTH, 1976b).

As has previously (5.1) been indicated, questions asked orally by a teacher (or a corresponding person) appear to affect the students' MGA more than written questions in a study material. Therefore, if correspondence education supplemented by telephone contacts is designed according to Rothkopf's model, the study organizer might consider systematically to stimulate the students' MGA by means of the telephone. For this purpose, not only teletutoring but perhaps even **telelecture** (FLINCK, 1975a) could be utilized. In other words, certain parts of the course could be communicated by telephone to one or more groups of students. If so, MGA-stimulating questions should be inserted into these telelectures (or, maybe rather, telelessons).

However, a prerequisite of telelectures is that correspondence students meet for – more or less – regular **face-to-face contacts** in a class, study circle, or the like. Therefore, *asking questions* directly in the classroom (etc.) would seem to be a more natural and maybe also a more effective way of providing oral questions in connection with students' working through a part of a correspondence course. In addition to this, the face-to-face teacher/tutor may of course also take other measures in order to stimulate the students' processing of the study material – i.e., their class 3 MGA.

Of course, the disadvantage of regular face-to-face contacts is that they – if they are compulsory (which, however, is by no means necessary) – circumscribe the students' freedom, usual in correspondence education, to choose the time and place for their studies. On the other hand practical experience (e.g., at NKS in Norway) indicates that the course completion rate may be considerably higher in combined study of this kind than in pure correspondence study.

A special form of face-to-face contact that may supplement correspondence study, without limiting the students' freedom other than with reference to time of starting the course, is *oral introductory courses* during, e.g., a weekend. This type of face-to-face contacts might turn out to be an efficient means of furthering class 1 and 2 MGA and thereby reducing the share of non-starters. By means of appropriate elements of directions, examples of learning objectives, and study hints, oral introductory courses might probably also affect students' class 3 MGA in a favourable way.

6.4 Rothkopf's model applied to correspondence education – a summary review

As was the case with Skinner's behaviour control model – when applying Rothkopf's model to correspondence education, the emphasis will naturally be on the *teaching material*. This would be devised as a »commentary course», i.e., a study guide to an existing basic study material (textbook or the like). The study guide should provide directions, information concerning the learning goals/objectives, questions with model answers as well as any necessary explanatory information in relation to the basic material.

One major purpose of the *two-way communication* should be to influence the students' class 1 and 2 MGA and, in doing so, provide them with initial help in starting their studies. This function can probably be best fulfilled by *face-to-face contacts*, e.g., of the type oral introductory course. Another possibility would be to use *telephone contacts* of the teletutoring type for this purpose, while *postal contacts* might give weaker effects in this respect.

Another natural function of the two-way communication is to stimulate the students' processing of the course material, i.e., their class 3 MGA. This can be achieved in the form of instructions and questions by post as well as by telephone (teletutoring and/or telelecture), or by face-to-face contacts (classes/study circle meetings etc.) running parallel to the correspondence studies. Probably, the simultaneous contacts would be superior to the postal contacts also with regard to this function.

However, the probable advantages of face-to-face contacts – in particular – must of course be balanced against the possible disadvantages of the fact that such contacts, if they are compulsory, circumscribe the students' freedom concerning time and place of study.

By use of *computer-assisted distance education on line* it would, among other things, be possible to ensure that questions of different kinds – first of all, assignments for submission – could always meet the student *after* he had worked through a part of the course (a study unit) and thereby be able to control his class 3 MGA to an optimal degree.

Combinations of various simultaneous contacts would also be possible, e.g., computer-assisted distance education on line combined with teletutoring.

7 Ausubel's advance organizer model

7.1 View of learning

Like other cognitivistic psychologists AUSUBEL (1963, 1967, 1968) maintains that the behaviouristic psychology with its limited stimulus-response scheme and reinforcement mechanism is unable to describe and explain *meaningful verbal learning* in a satisfactory way. The learning psychologist and the teacher must also consider and deal with the individual's »cognitive structure« and cognitive processes to be able to understand and influence his learning.

In its fundamental features, Ausubel's view of learning resembles that which Herbart introduced during the first part of the nineteenth century. Herbart thought that we learn new material in terms of what we already know. According to Ausubel's »subsumption theory of meaningful verbal learning and retention«, meaningful verbal learning can best be described as a process by which new material is related to existing knowledge in the individual's cognitive structure:

> New meanings are ... acquired when potentially meaningful symbols, concepts, and propositions are related to and incorporated within cognitive structure on a nonarbitrary, substantive basis. Since cognitive structure itself tends to be hierarchically organized ..., the emergence of most new meanings reflects the subsumption of potentially meaningful symbolic material under more inclusive ideas in existing cognitive structure. (AUSUBEL, 1967, p. 217)

Thus, meaningful knowledge emerges through a process, by which the new material is linked up with and incorporated within an individual's cognitive structure. As a rule, this is achieved by the new material being subsumed under more general ideas or concepts in the already existing structure. The relationship between the new potentially meaningful learning material and the existing cognitive structure is characterized by mutual influence or transfer. On one hand, the individual's previous knowledge and his existing cognitive structure[1] constitute the most important of all factors which influence learning and retention of new meaningful material. On the other hand, the cognitive structure will be changed by the new material.

Ausubel distinguishes between different kinds of learning along two independent dimensions. They may be characterized by means of the opposites meaningful learning – rote learning and reception learning – discovery learning.

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1) The relationship between the concepts *cognitive structure* and *cognitive content* (= what is here called »previous knowledge«) is described by Ausubel in the following way:

> Cognitive structure refers solely to the stability, clarity and organization of a learner's subject-matter knowledge in a given discipline. The actual ideas and information embodied in this knowledge are »cognitive content«. (AUSUBEL, 1963, p. 76)

As would already have been clear, Ausubel's interest with regard to the first of these two dimensions is concentrated on *meaningful learning*. Material obtained in a meaningful way, which consequently leads to understanding, is much easier to *learn* and is *retained* longer than rote material. It is also easier to *retrieve* from memory (AUSUBEL, 1968, pp. 111–112). Therefore, a lot of traditional learning-enhancing measures, e.g., repetition, distributed practice and recitation, have *less* effect on meaningful than on rote learning (AUSUBEL, 1963, pp. 186–192). The same applies to many of the behaviouristic principles of programmed instruction, as the importance of small learning steps, overt responses and externally provided feedback for reinforcement of students' answers (ib., pp. 193–212).

The type of meaningful learning to which AUSUBEL himself is particularly committed is meaningful *reception learning* (which corresponds to expository teaching), i.e., learning of already prepared material. Discovery learning – where the learner has an opportunity to discover principles etc. on his own – is important in solving several everyday problems, but has a strictly limited value in educational contexts (AUSUBEL, 1963, p. 17). At this point, Ausubel enters into a straight-forward controversy with, among others, Bruner (ib., pp. 145–172).

For certain purposes and target groups, discovery learning and independent problem solving may nevertheless be justified: when teaching pupils who are still in the concrete stage of cognitive development (cf. Piaget), or adults »who are relatively unsophisticated in the basic concepts and terminology of a given discipline«; further, if one intends to teach problem solving techniques, or to test whether students really comprehend ideas which they are able to verbalize (ib., pp. 143–144).

Thus, Ausubel does not completely reject laboratory work or similar learning situations where students are allowed to make discoveries (or rather, rediscoveries) themselves. This applies in particular to the markedly modified form of discovery learning called *guided discovery* (which, in fact, is rather a variant of expository teaching; ib., pp. 171–172). However, on the whole Ausubel pretends that making use of discovery methods leads to a wastage of time and resources. Consequently, *meaningful reception learning* is the subvariety of learning to which Ausubel devotes himself almost exclusively.

According to Ausubel, the most essential motivation for all meaningful learning springs from learning itself and the student's endeavour to acquire new knowledge and skills. Ausubel thus assumes a »cognitive drive« of great importance:

> Because meaningful learning provides its own reward, cognitive drive (the desire to know and understand, to master knowledge, to formulate and solve problems) is more important than in rote or instrumental learning, and is potentially the most important kind of motivation in meaningful learning. (AUSUBEL, 1968, p. 367)

7.2 View of teaching

According to Ausubel, the major aim of teaching is to disseminate knowledge. The teacher's most essential task is to *control* the students' learning activities. No large space for the students' inflence on the teaching seems to be permitted by this view:

> The battle cry of the progressives that the student must assume responsibility for his own learning has been distorted into a doctrine of pedagogic irresponsibility. It has been interpreted to mean that the student's responsibility is to self-discover everything he has to learn, that is, to locate and organize his own materials from primary sources, to interpret them independently, to design his own experiments, and merely to use the teacher as a consultant and critic. But education is not a process of self-instruction. Its very essence inheres in the knowledgeable selection, organization, interpretation, and sequential arrangement of learning materials by pedagogically sophisticated persons. The school cannot in good conscience abdicate these responsibilities by turning them over to students in the name of democracy and progressivism. (AUSUBEL, 1963, pp. 12–13; cf. 1968, p. 33)

Ausubel's way of expressing himself concerning the teacher's control of learning may even resemble Skinner's, e.g., when he speaks about »shaping» of the student's cognitive structure as a major teaching task (AUSUBEL, 1967, p. 235).

Nevertheless, the student must of course also, to some extent, take the responsibility for his own learning. This responsibility does however not concern the control of the learning. The student's role is instead to try actively to assimilate the teacher's instruction:

> The student takes appropriate responsibility for his own learning when he accepts the task of learning actively and seeking to understand the material which is taught; when he genuinely attempts to integrate it with what he already knows; when he does not avoid the effort and struggle of difficult new learning . . . ; when he takes it upon himself to ask the necessary questions about what he does not understand. (AUSUBEL, 1963, p. 13)

Thus, to accept the teacher's control of the learning does *by no means* imply being a *passive* recipient of subject matter.

7.2.1 Advance organizers

According to Herbart and his followers, a good lesson should always start with something that the students had already learnt. The purpose of this preparatory stage was to activate the students' previously acquired knowledge in order that they became prepared to meet the new material and integrate it into their existing individual bodies of ideas and concepts (BRUBACHER, 1966, p. 213).

In a similar way, Ausubel attaches extremely great importance to *the connecting of new material with the student's previous knowledge and cognitive structure*:

> If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly. (AUSUBEL, 1968, p. VI)

A consequence of this view might be that the teacher must analyze the students' cognitive structures and their content (AUSUBEL, 1963, p. 30; cf. LAWTON & WANSKA, 1977, p. 242). If so, the teacher should try to find out

to what extent each student has sufficient knowledge of such terms, concepts, and principles as are prerequisites of a meaningful and effective assimilation of the new material. He should also inquire into how this previous knowledge is organized in each student's cognitive structure. However, Ausubel has not expounded this idea to a degree that can be at all compared to the scope and interest he has devoted to another idea of how the connection with the student's existing cognitive structure can be facilitated: by using advance organizers.

By an *advance organizer* Ausubel denotes an introductory material of which the primary aim is to bridge the distance between what the student already knows and what he needs to know in order successfully to assimilate the new learning material. Such introductory material presents »... an ideational scaffolding for the detailed material to follow« (AUSUBEL, 1968, p. IX). Advance organizers

> ... are introduced in advance of the learning material itself and are also presented at a higher level of abstraction, generality, and inclusiveness ... (ib., 1968, p. 148).

Consequently, advance organizers are different from *introductory overviews* as well as *summaries* (AUSUBEL, 1963, p. 214). In contrast to summaries, advance organizers should be given *before* the learning material, since Ausubel maintains that it is essential that they influence learning in a proactive way. Moreover, both introductory overviews and summaries are generally written at the same level of abstraction (etc.) as the learning material, while advance organizers should be devised at a *higher* level of »abstraction, generality, and inclusiveness«.

Advance organizers can be divided into two major forms. *Expository organizers* are aimed at facilitating the structuring and meaningful acquisition of a completely new material, primarily by anchoring it in existing »subsumers« – i.e., more inclusive concepts and principles – in cognitive structure.

Comparative organizers are more common and of greater use. They are utilized when a new learning task contains partially known material. The purpose of an advance organizer of this kind is to point out similarities and differences between the new learning material and previously learned, related material.

7.2.2 Progressive differentiation and integrative reconciliation

The advance organizer idea is based on two general principles regarding how learners' cognitive structures are optimally affected through teaching – irrespective of subject matter area. One is called the principle of progressive differentiation, and the other the principle of integrative reconciliation.

The principle of *progressive differentiation* (AUSUBEL, 1963, p. 79–80; 1968, pp. 152–155) in a lesson series or teaching material implies that the most general and inclusive ideas should be introduced at the very beginning of the instruction. After that, the subject matter is gradually structured down to the specific details. In doing so, the teacher follows the hierarchical scheme for cognitive structures. In other words: Ausubel's model implies that teaching normally proceeds from the general to the individual, from the abstract to the concrete. When applying this model, inductive learning – e.g., of discovery type – must constitute an exception rather than a rule.

The principle of *integrative reconciliation* (AUSUBEL, 1963, pp. 80–81; 1968, pp. 155–158) means that »watertight bulkheads» should never be built in between different parts of a learning material. The teacher (writer) should instead endeavour to demonstrate how various concepts and principles are related to each other.

Advance organizers can very well be used to further progressive differentiation as well as integrative reconciliation. Progressive differentiation can be attained by means of ». . . a hierarchical series of organizers (in descending order of inclusiveness), each organizer preceding its corresponding unit of detailed, differentiated material» (1963, pp. 81–82). For this purpose, the advance organizers may be of the expository as well as the comparative form. In addition, comparative organizers are used for the purpose of furthering the integrative reconciliation of the learning material.

7.2.3 Further views on how a lesson series or material for written instruction should be designed

Before proceeding to a new subarea, students should have adequately mastered the previous material. This is a consequence of the two principles of progressive differentiation and integrative reconciliation. The consolidation of the material studied just before is facilitated through reviews, repetitions and exercises – not necessarily with explicit feedback. Thus, the purpose of these measures is *not* only to further the retainment of the material just learnt but, to a high degree, also to facilitate the integration of the subsequent material into the cognitive structures of the students, or, in other words: to promote *transfer* of learning.

With regard to *meaningful* learning, Ausubel maintains that multiple-choice questions when used in exercises and tests may in many cases be superior to questions with constructed answers. An obvious prerequisite is however that the multiple-choice questions are carefully designed and that the learning objectives are well suited to this kind of questions (AUSUBEL, 1968, pp. 300–301, 583–585).

For teaching programmes Ausubel recommends considerably larger learning steps than in programmes of Skinner type. *Meaningful* learning cannot be furthered by splitting up the material in a large number of very short parts with incessant interruptions for questions.

7.2.4 Teaching and motivation for learning

According to Ausubel, reinforcements and extraneous rewards are of little weight as regards meaningful verbal learning. The learner's cognitive drive, i.e., his search for knowledge and intellectual skills as a goal in its own, is much more important. Therefore, the teacher's most essential task with reference to motivation coincides with his most essential task on the whole – to teach as clearly amd effectively as possible. In doing so, he can arouse an initially unmotivated student's desire to learn more:

> The casual relationship between motivation and learning is typically reciprocal rather than unidirectional. . . . Frequently, the best way of teaching an unmotivated student is to ignore his motivational state for

the time being, and to concentrate on teaching him as effectively as possible. Some degree of learning will ensue in any case, despite the lack of motivation; and from the initial satisfaction of learning he will, hopefully, develop the motivation to learn more. (AUSUBEL, 1968, pp. 365–366)

7.3 Research related to advance organizers

The advance organizer model has been the source of comparatively extensive empirical research, in some cases connected with studies of mathemagenic activities. (In such cases, advance organizers have been used to stimulate students' MGA, instead of questions, goal descriptions, etc.) NELSSON (1976) has provided a survey of this research, while DAHLGREN (1975) has examined Ausubel's theory as well as a number of empirical studies. Among other fairly recent research surveys and critical contributions BARNES & CLAWSON (1975) and LAWTON & WANSKA (1977) may be mentioned.

In many studies – but far from all – the results obtained appear to support the hypothesis that advance organizers can facilitate the learning of subsequent material. This applies in particular to *comparative* organizers. However, the interpretation of the results is made difficult, among other things, by the fact that the empirical studies – as was the case with the MGA studies – have, as a rule, consisted of very short experiments of laboratory type. In addition, the concept advance organizer has been subject to partly different interpretations in different studies, which has probably contributed to the non-consistent results.

7.4 Summary of the model

Ausubel represents a cognitivistic view of learning. His major interest concerns ***meaningful verbal learning***. Ausubel describes such learning as a process by which new material is integrated into the individual's cognitive structure in a meaningful way.

The teacher's task is to exert an influence on this learning process. The model is characterized by a comparatively high degree of teacher control.

Such control implies fairly clear-cut objectives, as well as possibilities of evaluating the learning results in relation to these objectives (AUSUBEL, 1968, pp. 565–567). The types of objectives to which Ausubel's model is – in the first place – applicable, belong to the cognitive class: assimilation of verbal information, intellectual skills, etc.

When presenting new material the teacher should mainly endeavour to connect this with the students' previous knowledge and (individual) cognitive structures. The primary means of bringing about this integration with students' cognitive structures is ***advance organizers***, i.e., introductory material at a higher level of abstraction, generality, and inclusiveness than the proper learning material. Such organizers are aimed at anchoring the new material in higher-level concepts and principles (expository organizers) or at relating it to concepts and principles at the same abstraction level (comparative organizers).

According to Ausubel, the teacher should normally proceed from the general to the individual, through progressive differentiation by means of advance organizers. In doing so, he should at each new step make sure that his students have a satisfactory retention of the immediately preceding material. Related concepts and principles should be explicitly compared with each other, according to the principle of integrative reconciliation – as well as by means of organizers (comparative organizers, to be precise).

The most essential motivation promoting measure is – according to Ausubel – to appeal to the student's cognitive drive, simply by teaching as clearly as effectively as possible.

Exceptional resources with regard to teachers or instructional material are hardly implied by the advance organizer model. Nevertheless, certain intellectual efforts by the curriculum deviser and the teacher/material designer are required in order to plan a consistent curriculum and to prepare good organizers.

The model appears applicable, in the first place, to teaching of typically academic subjects at a secondary and tertiary level. According to JOYCE & WEIL (1972, p. 383) the advance organizer model is probably better suited to teaching material – thus, to written instruction – than to personal interaction in a classroom. It would maybe be possible, without abandoning the basic view of the model, to modify the model and perhaps even to improve it in certain respects. For instance, it does not seem to be necessary that organizers have always to be provided *in advance*. It might be imagined that references to previously learnt concepts and principles could, in many cases, be more easily and naturally – perhaps even more effectively – *worked into* the very study material (DAHLGREN, 1975, p. 49; cf. however, concerning such »intra-material organizers«, AUSUBEL, 1963, p. 214).

8 Ausubel's model applied to correspondence education

8.1 Is it fundamentally possible to apply the model to correspondence education?

In Ausubel's model, the pedagogical process is comparatively strictly teacher-controlled, and the model does not necessarily require any simultaneous communication between teacher and student. These two conditions make the model fundamentally well suited to »pure» correspondence education. As we have just seen, it may be even better adapted to written than to oral teaching.

8.2 The design of the teaching material

At the present time, there is probably no material for correspondence education that is designed *entirely* according to the advance organizer model. Nevertheless, as was the case with Rothkopf's model for written instruction, Ausubel's model appears to be fairly close to traditional design of correspondence teaching material. It would therefore be quite possible, when preparing such material for learning objectives of the classes verbal information and intellectual skills directly to follow Ausubel's directions.

In such a course one should start with the most inclusive concepts and principles and then proceed by progressive differentiation (more or less strictly realized) and integrative reconciliation to the most specific applications. Each new chapter – or at least each new study unit – should be introduced by means of an organizer with the purpose of relating the new material to previously studied material and other relevant previous knowledge. The relation should be pointed out by means of subsumption or comparison.

Extremely great care must be attached to conceptually clear texts and logical organization of the material. Each study unit should contain reviews, exercises (often with explicit feedback), and other measures aimed at consolidating the previously learnt material and – above all – at promoting transfer to following study units. The model does not imply any other measures to promote motivation than those just mentioned.

8.3 The functions of two-way communication at a distance

8.3.1 Postal two-way communication

When applying the advance organizer model to correspondence education, the start of a course appears to present a particular problem. If later parts are normally based on previous ones according to the principle of progressive differentiation, organizers in subsequent parts can, as a rule, link up with what

the students have learnt in previous parts of the course. But the question is how to design the *first* advance organizer(s) in a correspondence course. Does a correspondence educator have sufficient knowledge, not only about the target group's average level of previous knowledge, but also about each student's individual capacities to be able to meaningfully relate the introductory material to each student's cognitive structure? (Cf. NELSSON, 1976, p. 38, on the need of taking *individual* previous knowledge and cognitive structures into consideration.)

Here, the correspondence tutor in »pure« correspondence education seems to have an essential task: to adapt the *beginning* of the course, the learning material of the first study unit(s), as far as possible to each student's specific starting position. Of course, such an attempt would imply contacts between tutor and student already *before* the student submits his solutions of assignments in the first study unit. These initial contacts could, e.g., be based on a test of previous knowledge and/or other data required of the student before the start of the course.

As regards the *assignments for submission*, the course designer should consider the possibility to introduce a question by relating it to well-known concepts, e.g., in such way that it is put into a wider context. An introduction of this kind might work as an organizer and, consequently, make the students' cognitive structures more prepared for the assignment question (MÅNSSON, 1978).

Wherever possible with respect to the learning objectives, the assignments may very well be designed as multiple-choice questions.

Generally, the primary task of the assignments for submission and the correspondence tutor – in cooperation with the course material – should be to promote consolidation of material already learnt (or, at least, studied). In his remarks, explanations and comments on the whole, the tutor must endeavour conceptual clarity and logical cogency in order to further »... the stability, clarity and organization of ... subject-matter knowledge« (AUSUBEL, 1963, p. 76).

The correspondence tutor's comments could be devised as organizers – for this case one might perhaps coin the term »remedial organizers«. If a student has not managed to solve an assignment, the tutor would ask him to review certain parts. In order to help the student to integrate the material in a way that leads to full comprehension, the tutor would provide an organizer which introduces the student's review of the old material from a new angle. In this way, essential previous knowledge could, hopefully, be brought to the fore (MÅNSSON, ib.).

No further personal contacts between tutor and student would be necessary from Ausubel's view of motivation. In principle, the content of the two-way communication may be entirely subject matter-related.

8.3.2 Two-way communication supplemented by simultaneous contacts

One of the most essential problems confronting those wanting to apply Ausubel's teaching model to correspondence education appear to be connected with the start of the course – as was the case with Rothkopf's model. How

best to facilitate the *anchoring of the first parts of the study material in each participant's individual previous knowledge and cognitive structure?* In the previous section (8.3.1) we already discussed this problem and found this anchoring to be a possible task for the tutor in »pure» correspondence education. However, if other than postal contacts between student and tutor can be arranged, the linking up with individual previous knowledge and cognitive structure would probably be more easily achieved by means of simultaneous contacts than by postal contacts alone.

By use of **computer-assisted distance education on line** in connection with correspondence teaching it would be possible at the beginning of the course systematically to analyze each student's previous knowledge and cognitive structure. As a consequence of the analysis each student could obtain (on line or, possibly, by post) an appropriate introducing organizer, chosen by the computer. (Alternatively, the computer could of course advice the student to complete his previous knowledge before starting on the course.)

Furthermore, during the course the computer would be able to assist in the teaching situation by directing the student's learning efforts in an effective way. As was the case with the Rothkopf model, this must, mainly, be carried through by means of questions and exercises. All self-test exercises and/or assignments for submission – or at least some of them – could be presented, corrected, and commented on by the computer.

If a computer is not used, individual **teletutoring** would appear a valuable means of helping students with the beginning of the course.

Telephone contacts *during* the course should first of all be utilized to *promote students' comprehension of the material.* The telephone tutor ought to concentrate on unclear comprehension of essential concepts and principles, inadequate grasping of the relations between various parts of the material, etc. The initiative to the telephone contacts might be taken by the tutor – often in connection with his examining the student's submitted papers – as well as by the student (cf. FLINCK, 1976b).

Probably, the ideal means of serving these two purposes – anchoring the first sections of the course in the student's previous knowledge and individual cognitive structure, and facilitating the student's comprehension of the material – would be *individual* **face-to-face contacts** between correspondence tutor and student. Unfortunately, however, such contacts are often difficult to arrange in large-scale distance education. Physical distances and costs are two common obstacles to this kind of supplementary simultaneous contacts. Nevertheless, whenever possible, it would probably be sensible to try it.

On the other hand, when applying Ausubel's model *group* face-to-face contacts seem not to have any distinct advantage over individual telephone tutoring as a supplement to postal two-way communication.

8.4 Ausubel's model applied to correspondence education – a summary review

As was the case with both previous models, the application of the advance organizer model leads naturally to an emphasis on the design of the *teaching material.* In this context, progressive differentiation and integrative reconcili-

ation, both by aid of organizers, stand out as essential designing principles. Generally, an extremely great weight is attached to logical clearness and measures aimed at promoting transfer of learning.

Nevertheless, certain important functions of the *two-way communication* are conceivable, particularly to facilitate the starting period and to further the students' comprehension of the learning material. For these purposes, postal contacts may, with advantage, be supplemented by computer-assisted distance education on line, teletutoring, or – if possible – individual face-to-face contacts.

9 Egan's structural communication model

9.1 A cognitivistic method of programmed instruction

Programmed instruction is not only Skinner's and his followers' »linear» type – and, maybe in addition, Crowder's »branching» type of programming. As we have just seen, even teaching designed according to Ausubel's model could be called programmed. Another, most interesting, form of programmed instruction has been developed in England by J.G. Bennett and A.M. Hodgson and is (for somewhat obscure reasons) labelled »structural communication». The method has been described and discussed by EGAN (1972, 1974, 1976), in particular.

EGAN (1974, 1976) severely criticizes *Skinnerean teaching programmes* based on behaviouristic theory. Such programmes are not aimed and directed at comprehension but at automatized learning, Egan maintains. Consequently, they are unable to promote higher-level »synthetic» cognitive functions, e.g., creative ability.

Behind the development of the techniques for structural communication there is a theoretic model for various levels of intellectual activity (EGAN, 1976, pp. 16–18). The essence of this model is that we need some kind of intellectual challenge, in order to be able to raise our thinking from the usual »sensitive» level (or the very lowest, the »automatic», level) to a higher, more »conscious» – reflective – stage or to the very highest, the »creative», form. According to the model, we are normally inclined to perform every task at the lowest intellectual level possible. This model explains, Egan thinks, why common linear teaching programmes of Skinner-type are unable to develop thinking at higher levels. Such programmes *can* be worked through at a »sensitive» level – i.e., without having switched on any higher intellectual functions. Consequently, they *are* – according to Egan – worked through in this way.

Egan also criticizes *teaching programmes of branching-type*. One major reason is that such programmes require multiple-choice questions. According to Egan, it is very difficult (although not impossible) to design multiple-choice questions at a sufficiently high cognitive level.

Structural communication is a programming technique that is aimed at counteracting passive and meaningless learning. It tries to force the students to think, to make use of their cognitive resources. The *learning goals*, towards which teaching primarily should be directed, are cognitive goals at a high level:

> The basic requirement is to be able to reproduce conditions of challenge and response that elicit judgement, creativity, decision making and hypothesis formation. (Quotation from J.G. Bennett, in EGAN, 1976, p. 15)

Thus, the primary aim is close to what, e.g., Bruner considers to be the most important goal of teaching. (Cf. chapter 11!) Structural communication might perhaps even be introduced as »... the enbodiment of the pedagogical principles that Bruner advocates», EGAN (1976, p. VII) thinks.

Moreover, the meaning of the term *structural* in »structural communication» is reminiscent of what Bruner has in mind when writing about »structure»:

> ... the most prominent ideas underlying structural communication come from Gestalt psychology rather than S–R theory. ... Everything that is interesting and significant is coherent. It is more than the sum of its parts, and it makes sense only as a whole. The wholeness derives from structure. ... if it is desired that a student be able to fully understand and use what he is taught, then the communication needs to be structured so that it transmits an understanding of the relationships between facts as well as knowledge of the facts themselves. (EGAN, 1972, p. 67)

A distinction is that Bruner appears to put greater stress on *the* basic structure of a complete subject matter field, while representatives of structural communication design and try to communicate one of several possible structures for each limited teachable part (study unit) of a subject matter field.

In contrast to traditional programming, structural communication makes real individualization possible, Egan maintains, and gives each student an opportunity to compose his own answers – thanks to the specific programming technique used.

9.2 The technique

9.2.1 The basic form: teaching material for individual study

The material is divided into *study units*. The simplest type of a study unit is normally contained in a booklet of between 10 and 15 pages. It is intended for about one hour of individual study. A study unit consists of six interdependent parts:

1 Intention
2 Presentation
3 Investigation
4 Response matrix
5 Discussion
6 Viewpoints

In the first part, *intention*, the main theme of the study unit is briefly introduced. The author tries to relate it to previous study units or to other relevant previous knowledge facilitating the understanding of the new material. This connection can be devised as an advance organizer (EGAN, 1976, pp. 3, 19). The author may also, if he wishes, use this part for a presentation of behavioural objectives.

In the second part, the learning material proper is provided. This *presentation* may be written like a section in an ordinary textbook. It may however just as well consist of works of poetry or fiction, instructions for an experiment or an excursion, or even a conventional linear programme – on the whole, everything that can be investigated and discussed in the following parts of the study unit.

The third part, *investigation*, contains a few problems. Together, they should cover the major aspects of the theme of the study unit and illuminate the »structure» of the theme. All problems are designed at a comparatively high cognitive level in order to challenge the students to mobilize their intellectual resources.

As a rule, the fourth part – the *response matrix* – contains 10–30 »items». These express facts, principles, theories, opinions, or mathematical formulas, etc. from the study unit – i.e., all essential components of the main theme – in a condensed and randomized form.

The student's task is to compose a solution of each problem by choosing, not one particular item from the response matrix, but an appropriate *combination* of items. Generally, several partly different response combinations are quite possible – no problem for structural communication has only one »correct» solution. If an item has been used for the solution of one problem, it is quite conceivable that it should also be chosen for another problem, but now in a new context, from another perspective.

In this way, the representatives of structural communication contend, the students get practice in discovering structures, relations between facts, concepts, principles, etc.

An example of an investigation section and a response matrix is shown in *figure 2* (see next page).

In the *discussion* section, the students' answers are first analyzed in a »*discussion guide*». Examples: »If you included in your response items 4 or 6, read comment A.» – »If you omitted from your response items 7, 12, and 18, read comment B.»

As a rule, a fairly large number of *discussion comments* are provided, referring to various possible response combinations. The author is given considerable freedom to use his pedagogical imagination, in order to point out inconsistencies in the student's answers, demonstrate relationships which the student has not discovered, suggest unusual but quite possible combinations, etc.

From the discussion comments the students are – if required – referred back to the presentation and investigation sections. Cf. *figure 3*, which shows schematically how a study unit is built up and how the six parts are interrelated.

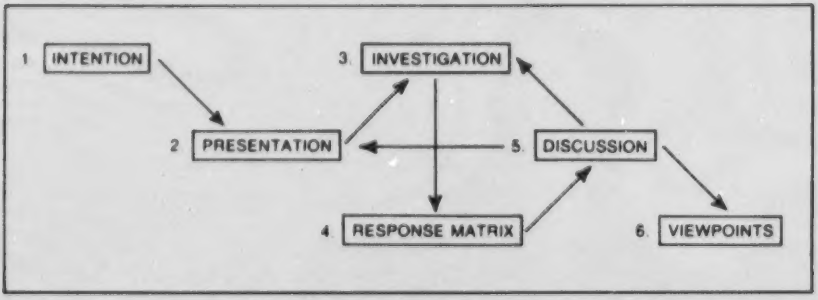

Figure 3. A graph of the student's way through a study unit in a structural communication programme (EGAN, 1976, p. 20)

INVESTIGATION

Problem 1
A given amount of nutritious material can be obtained in one of two ways:

(i) Consuming a large quantity of food with low nutritional value and extracting the nutritious part.
(ii) Consuming food with high nutritional value, in which case less bulk is needed.

The second method is more frequently employed by the higher animals. Which items of the Response Matrix indicate factors that help such an animal to obtain the most nutritious food for itself from its environment?

Problem 2
It is not adequate for efficient nutrition merely to ensure that the food which is eaten is pleasant in taste and appearance, has a high nutritive value, and can be taken into the organism. Another important factor is to what extent the nutritive value of the food can be made available to the organism which eats it, and to what extent nutritive material passes through the gut and is lost in excretion. Remember, this loss refers only to the individual and not to the cycle as a whole. In fact it may well provide nutrition for some other organism. Select from the Response Matrix those factors which enable the organism to derive maximum benefit from the food as it passes through the gut.

Problem 3
The utilization of the food material by the body is of prime importance and is, in a certain sense, the key to efficiency. What factors do you consider to be important in the economy of the release of energy and materials from the food molecules, once they have been absorbed from the gut and incorporated into the organism?

Problem 4
How does the effective utilization of energy from the food make for more versatile day to day functioning of the organism? Apart from the energy requirements during growth, and for the maintenance and repair or replacement of old tissues, there are certain ways in which energy is consumed which are to the ultimate benefit of the organism as a whole. Which items of the Response Matrix do you think come under this category?

RESPONSE MATRIX

coordinated muscular system 1	mucus or cilia 2	technique for storing food and energy 3	ability to select diet 4
excretory system 5	division of gut into specialized functional regions 6	heart and circulatory system 7	gut microfauna and flora 8
parasitism as a way of life 9	temperature control 10	nervous system and hormones 11	osmotic control 12
senses— sight, smell, taste, etc. 13	division of labour between internal organs of the body 14	periodic feeding 15	increased body size 16
skeletal tissues 17	heterotrophism as a way of life 18	correlation of enzyme type with dietary input 19	lungs or gills 20

Figure 2. Investigation section and response matrix in a study unit on nutrition and metabolic efficiency (EGAN, 1974, pp. 54–55). To each problem, the student is supposed to compose a solution by choosing a number of items from the response matrix.

The concluding section, *viewpoints*, may be used, e.g., for a general summary of the main theme. Alternatively, the author may bring his personal opinions to the fore and/or suggest further readings related to the topic.

9.2.2 Specific varieties

The structural communication technique is used not only in study units of the kind just dealt with. Egan describes three additional varieties: simulation units, assessment units, and discussion units.

The main difference between a *simulation unit* and a study unit of the basic form is in the kind of problems with which the student is faced. In the investigation section of a simulation unit, the student is placed into a simulation of a real problem situation, e.g., of the kind which a scientist or an administrator may meet. Units of this type might promote real discovery learning, according to EGAN (1976, pp. 53–54).

Specific *assessment units* may be composed of comparatively unstructured study material – e.g., a number of documents – and an investigation and response matrix part plus a card or a sheet where the student can mark his response combinations. In this way, representatives of structural communication maintain, it is possible to assess the students' ability to »organize knowledge», i.e., to handle material in such a way that the wood, not only the trees, is seen.

Specific *discussion units* contain only investigation and response matrix sections. Such units imply that the information has been acquired from another source. They are used as a basis for subject matter-related discussion in a class or in smaller groups.

9.3 What can be achieved by means of structural communication?

A programme prepared according to the principles of structural communication controls the student's way through the programme and provides confirming or correcting feedback. In these respects, it corresponds to more conventional teaching programmes.

To some extent, at least, a structural communication programme also individualizes learning. Theoretically, there are more than a million possible solutions to each problem. Although, in practice, only a modest fraction of these possible solutions are reasonably plausible, the student is still given considerable freedom to compose his answers – and accordingly, to choose his individual path through the programme.

In addition, a programme of this kind might stimulate the students to thinking at a comparatively high level. According to the proponents of this view, the creative ability of the students is not inhibited by structural communication, but is rather given a fair chance of development.

Not only the kind of problems used and the design of the response matrix, but also the author's »dialogue» with the student in the discussion section has the purpose of promoting higher-level cognitive functions, including creative thinking. In principle, there should never be just one correct response com-

bination for a problem. A number of possible combinations are tolerated and are discussed from various aspects in order to further the student's own thinking.

Empirical field tests of available programmes seem to demonstrate that they actually do individualize learning insofar as different students find various substructures and, consequently, give various item combinations as responses. These individual response inclinations appear particularly valuable when working with the discussion unit variety, since the subsequent oral discussions in classes or groups tend to be more animated and more informed than usually was the case.

Nevertheless, unambiguous empirical evidence that the technique really promotes higher-level learning, thinking, and creativity seems to be still lacking – and is, of course, difficult to procure (EGAN, 1976, pp. 27–33).

9.4 Summary of the model

Structural communication is *a cognitivistic method of programmed instruction*. It is aimed at furthering higher-level learning, thinking, and creativity, primarily by means of the central components of a structural communication programme – the investigation, response matrix, and discussion sections.

The model is characterized by a modest degree of control of the students' learning (considerably lower than in a linear programme of Skinner type). The students are comparatively free to »compose» their answers and are allowed to arrive at several different correct, or at least acceptable, solutions of the same problem. In other words, the learning objectives can neither be fixed in detail beforehand, nor be exactly the same to all students.

The teacher's/programme designer's major tasks are organizing the instructional material so as to communicate a meaningful structure to the students, and confronting them with intellectual challenges of a kind that compels them to attack the study material at a comparatively high cognitive level.

The designing of a structural communication programme is therefore a fairly demanding kind of work. In particular the preparation of a good response matrix appears to be a task requiring a great deal of special training and very profound subject matter knowledge.

Structural communication can probably be used in a majority of cognitive subjects; even attitudes might be affected by means of this technique. A limitation – directly following from the aim of the technique – is that it implies subject matter of a certain degree of complexity and, thus, does not lend itself very well to basic cognitive skills:

> Unless the material to be taught, discussed, or assessed is sufficiently complex to allow the construction of alternative approaches and its breakdown into matrix items, then the S.C. techniques cannot be used. S.C. would, then, not be much use either for teaching or testing very basic skills. (EGAN, 1976, p. 117)

Structural communication is a form of written instruction. Like other forms of programmed instruction it can, however, be integrated into classroom teaching and other forms of oral instruction. The core of the model (problems with response matrix) appears well suited to discussions in classes or smaller groups.

10 Egan's model applied to correspondence education

10.1 Is it fundamentally possible to apply the model to correspondence education?

Since structural communication is a form of written instruction, the model is in principle applicable to correspondence education. Actually, at least one distant teaching institution has made a practical attempt to use structural communication principles when designing courses for correspondence study (LAMPIKOSKI & MANTERE, 1978).

Everyone familiar with correspondence teaching would, in fact, discover a number of similarities between a study unit in a structural communication programme and a study unit in a correspondence course. The obvious difference lies in the response matrix. Egan tries hard to demonstrate that the response matrix – combined with the problems to be solved – cannot be conceived as »... an unwieldy and unnecessarily complicated kind of multiple-choice technique» (EGAN, 1976, p. 28). (He has however *not* shown that it would be *impossible* by means of a series of well-designed multiple-choice questions to confront students with an intellectual challenge similar to what can be achieved by means of problems + response matrix.)

It would probably not be advisable to devise a comprehensive correspondence course entirely according to the structural communication model. Therefore, the discussion in the subsequent sections implies the following alternative designs:

- short correspondence courses, that are entirely based upon the structural communication model
- more extensive correspondence courses, in which e.g. certain study units are of the structural communication type, or each study unit contains certain elements of structural communication.

10.2 Two possible ways to apply the model to pure correspondence education

In a correspondence course, those components characteristic of structural communication – the investigation, response matrix, and discussion sections – could be used in two alternative ways: either as elements of the teaching material, or as features of the two-way communication between student and correspondence tutor.

10.2.1 The structural communication technique as a feature of the teaching material

In the teaching material, the problems of the investigation section with the additional response matrix could be inserted as *»self-test exercises»*. If the study units of the course in question are considerably more extensive than a normal structural communication programme, two or more exercises of this kind could be provided. *»Model answers»* to the exercises would be given as usual, although in the same form as the discussion section of a structural communication programme.

If the teaching material is devised this way – entirely or partially (cf. 10.1) – as a structural communication programme, the assignments for submission should probably be best designed as essay-type questions for application of the material studied. Alternatively, the two-way communication could be of the »reverse» form, i.e., be based on questions from the students to the correspondence tutor. The rationale of this arrangement would be the fact that problems of structural communication type may stimulate thinking and evoke questions that can probably not always be answered only by utilizing the teaching material.

10.2.2 The structural communication technique utilized for postal two-way communication

The alternative way of applying the structural communication technique to correspondence education is to use the investigation, response matrix, and discussion parts directly for the two-way communication between student and tutor.

In this case, the *assignments for submission* would thus consist of a number of problems plus a response matrix, whereas the self-test exercises might be of a less sophisticated kind. Preferably, the programmed discussion comments to the assignments for submission could be provided with the aid of a computer off line (cf. BÅÅTH & MANSSON, 1977, pp. 40–41). If so, the correspondence tutor's routine tasks would mainly consist in answering and discussing students' questions, which may also be fairly numerous in this form for application of the structural communication model.

10.3 Postal two-way communication supplemented by simultaneous contacts

If the assignments for submission are provided in the form of problems + response matrix as in a structural communication programme, it would of course be conceivable that the student communicates his answers directly to a computer. If so, he could by **computer-assisted distance education on line** obtain discussion comments and an assessment – if any – immediately at his home terminal.

Supplementing **telephone contacts** in the form of teletutoring could be used for discussions on the student's choice of answer combinations, and on the programmed comments given in the teaching material or by the computer. It

would appear sensible to utilize supplementing face-to-face contacts, e.g., group meetings, in a similar way.

However, integrated face-to-face contacts might provide an additional possible method of application – an apparently promising method. Let us imagine a course material that is designed to contain only the intention and presentation sections of a structural communication programme (plus conventional self-test exercises and assignments for submission) – which would be fairly similar to a normal study unit in a correspondence course. If the participants of a group meeting have studied this material before they assemble, they could at the beginning of the meeting obtain the task of *working through a discussion unit* – i.e., problems plus response matrix (cf. 9.2.2!). This discussion unit should of course be based on the content of the correspondence study unit just examined at home. For good reasons, the subsequent oral discussions in the group may be expected to become both animated and meaningful (cf. 9.3).

10.4 Egan's model applied to correspondence education – a summary review

The structural communication model is aimed at furthering higher-level cognitive functions. Since, for this purpose, it requires a particular technique of instructional programming, the application of this model to correspondence education necessitates that a certain emphasis be placed on the design of the *teaching material*.

Nevertheless, *the two-way communication* would also contain essential functions, particularly if the assignments for submission are designed as problems plus a response matrix. If so, computer-assisted distance education – off line or on line – could very well be utilized for answers and programmed discussion comments.

Student-generated discussions related to the assignments and the programmed comments may be carried on by post or by telephone, but also – and probably even better – during face-to-face meetings. Such group discussion could, alternatively, be based on studies of a »discussion unit».

11 Bruner's discovery learning model

11.1 Introduction

According to advocates of *discovery learning* and related approaches, learning of arranged study material is inferior to learning where the student is faced with a problem and, in trying to find the solution, is given the opportunity to discover essential concepts and principles himself. NUTHALL & SNOOK (1973) have examined the view of learning and teaching propagated by the representatives of this approach, and have in addition summarized the research stimulated by it.

The discovery learning approach can be viewed as a reaction to such expository teaching where the importance of the student's *understanding* of the material, his intellectual absorption of the material, is neglected. (Ausubel maintains that the criticism delivered by representatives of discovery learning against rote learning of »dead» knowledge by no means affects the type of expository teaching which *he* advocates.)

Like many other current educational trends, the discovery learning approach has its roots far back in the past. One root can be traced back to Rousseau. Another apparently leads still farther away, to Socrates and his maieutics such as this method has been presented by Platon, e.g., in the dialogue Menon (SCHULMAN, 1972). A more recent approach has been that of Gestalt psychology; its theory of meaningful learning/problem solving as a sudden restructuring of the individual's perceptual field can be said to have been applied to teaching by the representatives of discovery learning. In recent years, some of the advocates have turned to Piaget's theory of cognitive development for support (NUTHALL & SNOOK, 1973).

One of the most famous advocates of discovery learning – but far from the most extreme – is BRUNER (1961, 1966, 1972). In the following sections, his view of discovery learning will be connected to certain other of Bruner's basic ideas on learning and teaching, above all his thoughts about learning the *structure* of a subject matter field (BRUNER, 1960) and about various *modes of representation* (BRUNER, 1966).

11.2 View of learning

Like Ausubel, Bruner represents a cognitivistic view of learning. The only kind of learning that interests him is *meaningful* learning. Bruner emphasizes however more strongly than Ausubel that human beings do not only react passively to stimuli. Man *tries actively to get* knowledge and *processes actively* the stimuli he receives. In doing so, man to a certain extent *produces* his knowledge himself (BRUNER, GOODWIN & AUSTIN, 1956). He goes »beyond the information given» (BRUNER, 1974).

To this basic view of learning, BRUNER (1961) connects the idea that *discovery learning* would agree best with man's active search for knowledge and, consequently, produce the best effects. An individual's own endeavours to find the solution of a problem and the following insight, when the problem is solved, result in really meaningful knowledge, since they involve the whole personality. Knowledge attained in this way remains the property of the individual to a greater extent than other kinds of knowledge. It is therefore comparatively easy to *retrieve from memory*, among other things:

> Let me suggest that in general, material that is organized in terms of a person's own interests and cognitive structures is material that has the best chance of being accessible in memory.
>
> – – –
>
> In sum, the very attitudes and activities that characterize »figuring out» or »discovering» things for oneself also seem to have the effect of making material more readily accessible in memory. (BRUNER, 1961, p. 32)

Discovery learning is also assumed to give better transfer effects than other learning: Concepts and principles which an individual has made his cognitive property by means of a »discovery» are more easily applied to new situations.

On the whole, discovery learning promotes students' intellect and ability of *independent thinking*, Bruner contends. In particular, such learning trains the cognitive skills of *finding and solving problems* on one's own:

> Of only one thing I am convinced. I have never seen anybody improve in the art and technique of inquiry by any means other than inquiring. (BRUNER, 1961, p. 31)

Pure discovery learning is however time-consuming and must consequently be used only to a limited extent (BRUNER, 1972). Therefore, discovery learning, or extremely problem-oriented learning, should above all be devoted to the *structure of a subject-matter field*.

The structure is primarily given by the basic concepts and principles of the subject-matter field. (Cf. Ausubel's idea of how bodies of knowledge are built up hierarchically, from the most general and abstract concepts and principles to the individual applications.) If a student has mastered the basic structure, he will have less difficulties in grasping and learning other material within the same field, and he will more easily retain the new material. The reason is that he has obtained a meaningful framework of knowledge, by means of which he sees the essential relations within the subject matter field and is able to understand the details:

> Grasping the structure of a subject is understanding it in a way that permits many other tings to be related to it meaningfully. To learn structure, in short, is to learn how things are related. (BRUNER, 1960, p. 7)

Like Ausubel, Bruner emphasizes *intrinsic motivation* – the individual's own »will to learn». Among such intrinsic motives for learning Bruner mentions curiosity and, above all, the drive for competence (BRUNER, 1966, 1972). Discovery learning is supposed to stimulate, to a particularly high degree, such intrinsic motivation (BRUNER, 1961).

11.3 View of teaching

As might be evident from the previous section, teaching should, according to Bruner, primarily be directed towards helping the students to gain an insight into the structure of a field of knowledge – its basic concepts and principles as well as their interrelations. This teaching should, as far as possible, be problem-oriented and give the students opportunities of own investigations, tests of hypotheses, and discoveries.

Method and goal coincide partially (SCHULMAN, 1972; NUTHALL & SNOOK, 1973). The *goal* is not just to acquire the actual knowledge. Rather, the goal is to acquire it in a *way* that can be assumed to train the students' intellectual capacities and stimulate their curiosity and competence motivation – i.e., to acquire knowledge through discovery learning. Knowing is a *process*, not a product:

> We teach a subject, not to produce little living libraries from that subject, but rather to get a student to think mathematically for himself, to consider matters as a historian does, to take part in the process of knowledge-getting. Knowing is a process, not a product. (BRUNER, 1966, p. 72)

From this follows that teaching goals can be specified only in fairly broad outline and can be attained in partly different ways by different students participating in the same course.

As a consequence, the control of the teaching/learning process is weaker in Bruner's model than in Ausubel's. The student is allowed considerable freedom to search, independently or in a dialogue with the teacher and/or fellow-students, for solutions to problems presented by the teacher or by teacher and students together.

Among practical means to present meaningful problems and to further discovery – or, in the wording of BRUNER (1972): to »engineer» discovery – Bruner particularly recommends the use of contrasts. The teacher should start with something well-known to the students and then introduce a contrast which, seemingly, conflicts with the students' experience. In this way a problem arises. In the ideal case, the contrast creates an optimal degree of insecurity which stimulates the students to investigate the problem, to draw up hypotheses, and to try to discover those concepts or principles underlying the problem.

The teacher's role is first to plan the lessons in such a way that they are concentrated on essential problems. In addition, he should present the material needed as a basis for the students' problem-solving. This ought of course to be done in a manner which promotes active problem-solving and discovery learning – e.g., by use of contrasts. In addition, he should consider various *modes of representation*.

Bruner distinguishes three modes of representation: enactive, iconic, and symbolic:

> Any domain of knowledge (or any problem within that domain of knowledge) can be represented in three ways: by a set of actions appropriate for achieving a certain result (enactive representation); by a set of summary images or graphics that stand for a concept without defining it fully (iconic representation); and by a set of symbolic

> or logical propositions drawn from a symbolic system that is governed by rules or laws for forming and transforming propositions (symbolic representation). (BRUNER, 1966, pp. 44–45)

Intellectual development is assumed to proceed from enactive, via iconic, to symbolic representation of the world. Bruner considers it likely that an instructional sequence should normally take the same direction. Of course, there are students who, with good results, are able to profit by a wholly symbolic (e.g., written verbal) presentation of a problem area, completely new to them. This implies however that they possess a rich amount of previously acquired mental images which can give a meaning to the symbols:

> . . . when the learner has a well-developed symbolic system, it may be possible to by-pass the first two stages. But one does so with the risk that the learner may not possess the imagery to fall back on when his symbolic transformations fail to achieve a goal in problem solving. (BRUNER, 1966, p. 49)

When students perform their most essential tasks – apply themselves to laboratory and theoretical problems – the teacher should function only as a *guide* or tutor. He must not, in advance, reveal the principle, rule etc. to be learned, but he should give appropriate advice and cues when needed.

A delicate tutorial task in this connection is to provide feedback at the right moment:

> Knowledge of results should come at that point in a problem-solving episode when the person is comparing the results of his try-out with some criterion of what he seeks to achieve. Knowledge of results given before this point either cannot be understood or must be carried as extra freight in immediate memory. Knowledge given after this point may be too late to guide the choice of a next hypothesis or trial. (BRUNER, 1966, p. 51)

Corrective feed-back should be given in such a way that the student will not remain dependent on the teacher's help longer than necessary. Eventually, the student has to take over the corrective function himself.

The *evaluation* of the students' learning appears somewhat problematic in the discovery learning-model. As we have seen, the goals cannot be decided in detail, and they must be allowed to vary between different individuals. Moreover, goal and process partially coincide. On the whole, the goal is to learn essential generalizations by (re)discovering them oneself. But:

> In the discovery process it may not be at all certain exactly *what* an individual is learning, which makes it extremely difficult to determine *how*, or even *if*, learning and forgetting are taking place. (NUTHALL & SNOOK, 1973, p. 62)

In practice, the criterion of students' discovery learning is often their comprehension of the basic principles of a subject matter area and their ability to apply these principles to new problems. For this purpose, test questions may be of the multiple choice type as well as of the essay type (BRUNER, 1960, p. 30).

11.4 Research on discovery learning

The discovery learning approach of teaching, of which Bruner – as is mentioned – is only one among several representatives, has given rise to empirical research with varying directions (NUTHALL & SNOOK, 1973). On one hand, teaching aimed at discovery learning has been experimentally compared with more traditional, expository teaching. On the other hand, particular attention has been paid to certain factors that possibly influence the learning processes in discovery learning. These latter studies have tended to become gradually more laboratory-like, while the former – the experimental comparisons – have hardly provided unequivocal results (SCHULMAN, 1972).

Certain results seem to indicate that above all abler students react favourably to comparatively unstructured teaching methods aimed at discovery learning. However, not even at this point are the research results unanimous (CRONBACH & SNOW, 1977). This may still be partially a consequence of the difficulties, previously touched upon, to evaluate discovery learning.

11.5 Summary of the model

Like Ausubel, Bruner represents a cognitivistic view of learning. Nevertheless, Bruner lays a definitely greater emphasis on learning as an *active*, knowledge-producing process.

Committed problem solving leading to discovery learning is supposed to give more favourable over-all learning effects than other kinds of learning.

According to Bruner, motivation and ability both to retrieve and to apply the learned material is promoted by discovery learning, as well as independent thinking and problem finding and problem solving skills. Consequently, teaching should be problem-oriented and primarily concentrated on the basic concepts and principles which together form the structure of the subject matter field.

Goal and process partially coincide. The goal is not to attain specified knowledge details but to acquire concepts and principles in such a way as thereby to learn the process of thinking and searching for new knowledge. From this follows that the evaluation of the students' learning becomes more problematic than in the models hitherto dealt with.

The model implies comparatively weak control on the part of the teacher. Typically, he plans problem areas and facilitates problem insight and problem solving by appropriate means, e.g., contrasting facts, cues, and feedback at the right moment. Normally, instruction takes the form of discussions with essential elements of individual independent work.

In order to further his students' understanding, the teacher takes pains not to use a more abstract mode of representation than corresponds to the students' cognitive level. It may often be advisable to let a teaching sequence start with enactive manipulations of concrete reality, and then proceed, via iconic representation, to verbal or other kinds of symbolic representation.

To be able to carry through problem-oriented teaching, teachers quite likely need some special training in the very technique. The model also implies careful curriculum planning. Material resources, other than those generally available at schools, appear however to be unnecessary.

In its fundamental features, the model might be applicable to all major kinds of learning. Nevertheless, Bruner is particularly interested in higher-level cognitive learning goals, such as the ability to search for knowledge and solve problems on one's own.

12 Bruner's model applied to correspondence education

12.1 Is it fundamentally possible to apply the model to correspondence education?

Bruner's basic view of learning – implying that knowledge is something that the learner searches and attains actively – is apparently shared by a number of representatives of distance education, like WEDEMEYER (1976). The cognitivistic approach to learning also attracts the interest of theoretical researchers at institutions teaching by correspondence, e.g., LEHNER (1978). Nevertheless, Bruner's discovery learning model of teaching is not obviously applicable to correspondence education.

The required concentration on the structure of a field of knowledge can be achieved, without fundamental difficulties, during the careful planning that is natural in correspondence education. The case seems however to be different with the requirements of various modes of representation and methods promoting discovery learning. Moreover, the evaluation of students' learning – which is far from easy to perform in classroom teaching carried on according to Bruner's model – appears even more problematic in a distance teaching situation, where the teacher/evaluator has only the students' written products to assess and thus is unable to study *how* the learner tries to attain knowledge.

In the following section we will first discuss if it is possible to determine in concrete terms the learning material in correspondence courses and to make correspondence teaching problem-oriented with a view to discovery learning.

12.2 The design of the teaching material

The course material can be built up around *problems* intended to shed light on essential concepts and principles. The problems may be concentrating on contrasts and be designed as cases with adjunct questions, laboratory exercises, etc.

One difficulty is the desirable linking up with the students' previous experience. Very seldom, detailed data on the students are collected in advance. The course writer/editor must therefore probably assume – and try to link up with – experiences that are sufficiently general that they can be supposed to be common to at least the majority of the students.

The problem-searching *dialogue* between teacher and students, often desirable, causes other difficulties, and the same applies to the teacher's *guidance* and his giving *feedback* at the very right moment. At these points in the model, face-to-face communication or some other kind of simultaneous contact between teacher and students seem to be presupposed. To a certain extent, it might nevertheless be possible to simulate this two-way communication. If so, the problem-searching dialogue could be simulated in a printed or, e.g., audiotaped teaching material by means of

- explicit questions to the distant student, supplemented by model or specimen answers
- fictitious dialogues
- a discussion mode of presentation.

Cues for solving the problems and information intended for feedback could be provided as specific parts of the material. If so, the student should be instructed to make use of these cues/this feedback only when needed.

The utilization of an *iconic* mode of representation by means of pictures, diagrammes, etc. would appear natural in teaching material devised for correspondence education (GRANHOLM, 1976a), although it is far from always used to the extent which would seem to be justified.

The need of the *enactive* representation mode in adult education is probably not too strong. Sometimes, however, this mode of representation may be desirable, which of course creates problems in pure correspondence teaching. Two alternative possibilities which at least to a certain extent meet the need of enactive representation are:

- sending concrete objects, physical models, laboratory material, etc. to the students (which actually is done in a number of courses, at certain correspondence schools – preferably in technology courses but also in biology, geology, etc.), and providing instructions on how this material should be used.
- encouraging the students to secure appropriate material themselves and giving instructions on how to investigate this.

12.3 The functions of two-way communication at a distance

12.3.1 Postal two-way communication

When using Bruner's model in a correspondence education context, the *assignments for submission* should apparently consist of *problems requiring comprehension and application* of those basic concepts and principles which the study unit has tried to illuminate.

Since the feedback in postal two-way communication is, as a rule, fairly slow (1–2 weeks), assignments for submission do not lend themselves very well to »*discovery problems*», i.e., problems aimed at leading to the student's discovery of a concept or a principle. As we have seen, such problem-solving requires – according to Bruner – guidance and feedback *at the right moment* during the student's work on the problem. Such timing is not possible in a distant teaching situation with only postal two-way communication. Consequently, »discovery problems» should be included in the actual course material, not in the assignments for submission.

Which *type* of assignment questions one chooses seems however to be of much less importance, according to Bruner:

> It is obvious that an examination can be bad in the sense of emphasizing trivial aspects of the subject. Such examinations can encourage teaching in a disconnected fashion and learning by rote. What is often

> overlooked, however, is that examinations can also be allies in the battle to improve curricula and teaching. Whether an examination is of the »objective« type involving multiple choices or of the essay type, it can be devised so as to emphasize an understanding of the broad principles of a subject. (BRUNER, 1960, p. 30)

Thus, multiple-choice questions can be utilized as well as essay questions, provided that they test what they ought to test – understanding (and application) of essential (concepts and) principles.

Since the learning goals cannot be fixed in detail and must be allowed to vary between different individuals, students should themselves be given a certain amount of *freedom to choose among the assignment questions* suggested by the correspondence school. In addition, it might be desirable that the questions permit *more than one correct* – or acceptable – *answer*. (Cf. the »problems« in the structural communication model!)

In his work, the *correspondence tutor* should concentrate on encouraging the students to independent thought and to discovering knowledge on their own. Therefore, he must not lay too great stress on correcting and commenting on details, if these details do not shed light on essential concepts and principles.

The correspondence tutor would be able to provide *help* that is more adapted to the individual than could be worked into the teaching material. To start with, the tutor should try to form such an acquaintance with the students, that he can – at least to some extent – link up with their individual previous knowledge and experience, when he tries to help them to understand essential concepts and principles. As aids for this purpose, the tutor may use a test of previous knowledge, a questionnaire at the beginning of the course and/or personal written communication.

If, in his solutions to application problems, a student demonstrates that he has not fully mastered the basic concepts or principles, the tutor should provide comments that are aimed at helping the student to insight. This implies that the tutor should not, in the first place, give the student the correct solution (or one of the acceptable solutions) but rather try to put him on the track by means of questions, cues, etc. If the tutor succeeds in getting the student to view the problem from a new angle, this might help him to discover the solution (or one acceptable solution) and thus to gain insight.

This help should however be provided with the long-term purpose that the student will eventually learn to manage these functions himself:

> Instruction is a provisional state that has as its object to make the learner or problem solver self-sufficient. Any regimen of correction carries the danger that the learner may become permanently dependent upon the tutor's correction. The tutor must correct the learner in a fashion that eventually makes it possible for the learner to take over the corrective function himself. (BRUNER, 1966, p. 53)

12.3.2 Postal two-way communication supplemented by simultaneous contacts

Thus, what has in this context been called Bruner's discovery learning model seems to be possible to apply to (pure) correspondence teaching. Nevertheless, the application is – as we have seen – far from obvious, and it puts heavy

demands on the teaching material. Probably, supplementing simultaneous contacts would make the application of the model considerably easier.

Computer-assisted distance education on line might be used in order to make a programmed dialogue possible and to provide immediate feedback to the students at each step during their solving of »discovery problems». In addition, it would be possible to give the assignment questions of comprehension and application type via the computer, although this appears comparatively less essential.

Certain opportunities for dialogue with guidance and rapid feedback could also be created by integrated **telephone teaching**. For this purpose, individual telephone tutoring would appear to be the most suitable form. However, group calls (telephone tutoring of two or more students simultaneously) as well as telelectures for common problem-oriented discussions could also be of a considerable value in distance education carried on according to the Brunerian model.

Face-to-face contacts could be utilized in various ways. One way which probably presents itself immediately is to give oral guidance – individually or in group – to clear away confusions and uncertainties, and to promote insight. (As regards the general outlines for this guidance, cf. above the section on the work of the correspondence tutor.)

Another, seemingly interesting, possibility is to invite the students to *work* – in cooperation with the teacher – *with the »discovery problems»* (which cannot, in this case, be too numerous) *during the face-to-face sessions*. If so, the following requirements of the model could be met in a comparatively easy way:

- a real (not simulated) dialogue,

on

- problems linking up with the participants' experiences and therefore meaningful to them
- a concrete, i.e., enactive, representation mode (e.g., laborative work), when desirable
- immediate guidance and rapid feedback during the problem-solving phase.

The problem situations can be devised in several different ways, even as instructional games.

The evaluation of the students' learning would also be facilitated by the face-to-face sessions. In this case, the teaching material could contain such material that is needed as background for the »discovery problems» and, in addition, be devoted to follow-up and consolidation of the discoveries made – by means of application problems, extended information, etc.

12.4 Bruner's model applied to correspondence education – a summary review

When applying Bruner's model to correspondence education, the emphasis will hardly be on the *teaching material*, as was the case with the models pre-

viously dealt with. On the contrary, a number of essential functions in the model would seem to be more naturally fulfilled by means of two-way communication.

The *postal two-way communication* should be concentrated on assignments testing comprehension and application of basic concepts and principles. The correspondence tutor's primary task would be to give each student individual help towards full insight. *Telephone teaching* of the telephone tutoring type could constitute a good support in this work. Even groups of students could obtain guidance by telephone. During such distant sessions the opportunity to discuss in a group over the telephone should be taken.

The students' work on the basic »discovery problems» might be programmed for *computer-assisted distance education on line*. It should, however, be pointed out that computer programmes of the dialogue type needed in this case must be considerably sophisticated. A more realistic alternative would probably be to let the students work on the »discovery problems» during *face-to-face sessions* of the group tutorial type. Of course, this applies only to students who can dispense with the freedom regarding time and place which is usual in correspondence study.

13 Rogers model for facilitation of learning

13.1 Introduction

The *humanistic* view of learning and teaching has several traits reminiscent of or in accordance with the discovery learning approach. Moreover, representatives of both currents of thought are referred to by the »open learning» movement (SILBERMAN ET AL., 1972). However, the humanistic view, with ROGERS (1967, 1969) as one of its main ideologists, has a point of departure partially different from that of the discovery learning approach. The two movements also differ with regard to the primary aim of teaching, the responsibility for the control of the students' learning, and the teacher's role.

Basic to the humanistic view is a belief in the individual human being's inherent resources and development potential, a belief which apparently has a certain affinity to Rousseau's idea of »the noble savage». The direct points of departure have been taken from personality psychology (above all, Maslow's theory of motivation) and psychotherapy (Rogers »non-directive therapy»).

13.2 View of learning

The kind of learning considered to have an essential value, is called *experiential learning* by ROGERS (1967). By that an extreme type of discovery learning is denoted, with the following characteristics:

1 *It has a quality of personal involvement.* The whole person in both his feeling and cognitive aspects is involved in the learning event.
2 *It is self-initiated.* Even when the impetus or stimulus comes from outside, the sense of discovery ... comes from within.
3 *It is pervasive.* It makes a difference in the behavior, the attitudes, perhaps even the personality of the learner.
4 *It is evaluated by the learner* ... The locus of evaluation may be said to reside definitely in the learner.
5 *Its essence is meaning.* When such learning takes place the element of meaning to the learner is built into the whole experience. (ROGERS, 1967, p. 38)

According to this view, *intrinsic motivation* is the only form of learning drive which has any value.

13.3 View of teaching

13.3.1 Non-directive teaching = facilitation of learning

The aim of teaching is not to procure already well-structured knowledge but to promote the process of discovery. It is essential to help students not only to learn how to learn and how to solve new problems, but also to gain a favourable attitude to learning and to developing one's own resources. The essential aim is the individual's development towards self-realization, and *the final goal* consequently is »the fully functioning person« (ROGERS, 1969).

In later works (e.g., 1967, 1969) Rogers avoids the word »teaching«. Instead he uses the term »facilitation of learning«. This is connected with the idea that teaching, according to the humanistic view, should be *non-directive*. The control of learning should thus, as far as possible, emanate from the student himself. This means that he should (1) choose his learning goals with respect to his own needs and interests, (2) take the responsibility for his own learning, and (3) evaluate his work and his learning results himself. In other words, *the main responsibility for goals and process as well as evaluation* will rest on the students themselves.

A consequence of this view is that the learning goals must be allowed to vary considerably between different students of the same course. From this follows, in turn, that curricula may be utterly individual and that most varying achievements may be judged equally satisfactory – according to the criteria laid down by the students themselves.

The teacher's main task is to provide various resources for learning – including himself. It is certainly the case that he should not decide on the learning goals, but he should be prepared to *help* each student to determine his individual goals. Moreover, he should not control the learning process, but at the same time he should be ready to suggest appropriate sources and learning methods. Although he should, finally, not actually assess the students, he should be able to help each of them to evaluate, as realistically as possible, his own results compared with his goals.

In his examples of various practical ways to further »experiential learning«, ROGERS (1967) deals with as widely differing methods as problem solving, simulation methods, encounter groups, and even programmed instruction. Rogers believes that short programmes covering well-defined areas *can* be excellent aids to students who are working on a problem and find that they have gaps in their knowledge which must be filled before they are able to solve the problem. However:

> It should be obvious that programmed learning has great potential risks if it is unwisely used. If it becomes a substitute for thinking in larger patterns and gestalts, if it becomes a way of stressing factual knowledge more than creativity, then real damage may be done. (ROGERS, 1967, p. 51)

13.3.2 The relationship between »facilitator« and learner

Although Rogers strongly emphasizes learning in contrast to teaching and attaches particularly great value to the student's own pursuit of knowledge,

the teacher's – the »facilitator's» – role is far from insignificant. Humanistic educators lay an especial stress upon the relationship between »facilitator» and learner. The promotion of the students' learning does not primarily depend on the instructor's teaching competence, on the profundity of his subject matter knowledge, nor on the utilization of particular methods or specific teaching material, Rogers maintains:

> No, the facilitation of significant learning rests upon certain attitudinal qualities which exist in the personal *relationship* between the facilitator and the learner. (ROGERS, 1969, p. 106)

A successful »facilitator of learning» is characterized by

1 *realness* or *genuineness*. This implies self-insight, accepting oneself and courage to display one's feelings.
2 *a positive valuing of other people*. This attitude implies the humanistic recognition of other individuals' human dignity on their own conditions. Rogers uses the terms »prizing», »acceptance», and »trust» to express this attitude. Not least consideration for the student's feelings is important. »What we are describing is a prizing of the learner as an imperfect human being with many feelings, many potentialities» (ROGERS, 1969, p. 109)
3 *empathy*. A good »facilitator of learning» is able, as it were, to see the world through the student's eyes – particularly with regard to the student's learning task and specific study situation.

Unlike most of the teaching models which we have hitherto dealt with, Rogers model is not explicitly based on or related to *empirical research*. Nor has it been evaluated by means of systematic empirical methods (GAGE & BERLINER, 1975). Nevertheless, the model might very well draw on the numerous research studies which – from other starting-points – have shown the importance of a personal relationship between teacher and student (BROPHY & GOOD, 1974).

13.4 Summary of the model

Rogers recommends an extreme type of discovery learning. Only »experiential learning» – learning characterized by the student's total involvement – has a real value.

Instead of »teaching», Rogers uses the term »facilitation of learning». The final purpose of the facilitation of the student's learning is his full self-realization.

The student controls his learning himself: he chooses his goals (perhaps within certain frames), takes the responsibility for the learning process, and evaluates his own learning work and its results. The teacher's attitude should be non-directive. His principal teaching task is to provide resources for the student's learning – including himself.

Rogers attaches great importance to the personal relationship between »facilitator» and learner. A good »facilitator of learning» is distinguished by »realness» (»genuineness»), positive valuing of other people, and empathy. To all appearances this makes great demands on the teacher's personal resources and/or psychological training.

Rogers' humanistic model is primarily aimed at the individual's self-development. But this personal development is assumed to have generally favourable effects on the individual's learning capacity. In this way, the model might be applicable to many kinds of »facilitation of learning« – not only to training in, e.g., interpersonal relations, but also to teaching in academic subjects:

> If social and academic development depends on the growth of the self, then that environment which most enhances the self becomes also the most appropriate for social and academic ends. Consequently, non-directive teaching is the recommended avenue for teaching academic subjects, increasing interpersonal effectiveness, and developing fully functioning persons. (JOYCE & WEIL, 1972, p. 220)

14 Rogers model applied to correspondence education

14.1 Is it fundamentally possible to apply the model to correspondence education?

Is there any possibility at all of applying the humanistic ideas of teaching to correspondence education? Can anything of the freedom of the student and the relationship between learner and »facilitator», to which Rogers attaches such great importance, be realized within the framework of correspondence education?

Let us discuss these two basic ideas – the students' freedom and the relationship between student and teacher – separately, and let us begin with the latter, the relational aspect.

14.1.1 The relational aspect

A research study by BRADY (1976) shows that the relationship between correspondence tutor and student actually can be of great importance. Moreover, in a survey of the last 90 years' literature on the correspondence tutor's role, BÅÅTH & WÅNGDAHL (1976) found, in many representatives of correspondence education, a faith in the importance of the teacher personality and the tutor-student relationship which might remind one of Rogers writings. The authors even felt that they could summarize their survey by means of the following compilation of more or less verbatim quotations from the literature:

> A good correspondence tutor
> – imagines what the students need
> – inspires the students
> – encourages them
> – likes people
> – is alive!
>
> (BÅÅTH & WÅNGDAHL, 1976, p. 20)

The similarity to Rogers three essential characteristics of the »facilitator of learning» – »realness», positive valuing of other people, and empathy – is obvious. Still, according to Bååth & Wångdahl, current practice seems, in many cases, not to correspond very well with this high appreciation of the distant tutor and his role.

Nevertheless, even if Rogers idea of the relationship between learner and »facilitator» should be seldom realized in the correspondence education of today, it might not be impossible to establish such a relationship. The physical distance and the delay of the communication caused by the exchange of letters need not be insurmountable obstacles.

14.1.2 The freedom aspect

Distant students' (and, in particular, correspondence students') independence or autonomy in the learning situation is dealt with in a number of works by WEDEMEYER (e.g., 1973, 1976) and MOORE (e.g., 1973, 1977). Especially Wedemeyer's studies might suggest the idea that correspondence education would be a prototype of the »open learning« implied by the humanistic model.

However, considerable care is required in the formulation of such a general proposition. HOLMBERG (1974, p. 1) points to the vagueness of the term »independent«, since it is not clearly stated *what* the student is supposed to be independent of. BÅÅTH (1976a) mentions that »independent study« might have the following possible meanings:

> (1) – freedom to choose (a) one's own goals and subjects, and/or (b) one's own specific learning objectives within the subject, *and/or*
>
> (2) – freedom to choose one's own way of reaching the learning goals and objectives (including possible freedom from teachers – face-to-face or at a distance), *and/or*
>
> (3) – freedom to evaluate one's learning progress oneself, *and/or*
>
> (4) – freedom from restrictions of space and time.
>
> (BÅÅTH, 1976a, p. 3)

In correspondence education, the student's freedom is normally restricted to (1a) the possibility to choose his own general goals and subjects within the limits presented by the courses on offer from the correspondence schools, and (4) the freedom to choose time and place for his studies himself – a freedom which is, in many cases, very considerable. As a rule, however, there is in a correspondence course no room for any great freedom in other senses of the word:

> In a correspondence course, there is seldom space for (1b) alternative *learning objectives*, nor can the student freely choose (2) an individual *way of reaching the objectives* more or less consciously fixed by the school. The course writer and the editorial team have not only determined the objectives but also the body of information from which to extract the knowledge, the medium (possibly media), the sequence of the study programme, the specific problems for exercise or review, and the right (or best) way to solve the problems – etc. . . . the fact is that correspondence courses do not normally leave much freedom to the student as regards the instructional process – hardly more than that experienced by ordinary students in a normal classroom.
>
> About the same applies to the (3) evaluation of the learning progress. As a rule we grade our students' solutions to assignments for submission, even in hobby courses where no certificate is needed. It is rare that we encourage the students to make *their own* assessments of their study activities, related to *their own* goals and objectives. (BÅÅTH, 1976a, p. 6)

Provided that this description is correct, Rogers idea of non-directive teaching seems to be realized only to a very limited extent in current correspondence education. HOLMBERG (1975, p. 9–10) has presented similar thoughts.

This does of course not rule out the *possibility* of realizing the freedom aspect of Rogers' model in correspondence education, as well as the relational aspect. DELLING (1975, 1976), who is a fervent propagator of open forms of distant education, actually considers that the distant teaching institution ought to work as a »helping organization». Its task should be to

> . . . take over, upon the wish of the learner, everything he cannot (yet) do for himself, with the tendency that the learner eventually becomes autonomous. Finally, the only function left for the helping organization is that of an information and documentation center . . . (DELLING, 1976, p. 20)

It remains however to analyse how such student-controlled learning could be realized within the *practice* of correspondence education. An attempt in this direction has been made by LJOSÅ & SANDVOLD (1976). In a paper on »The student's freedom of choice within the didactic structure of a correspondence course», they have tried to demonstrate how the correspondence students' freedom of choice could be substantially extended:

> Instead of letting the course material choose for him/her, the student himself/herself will be the active part, taking the initiative in the choices that have to be made. Through a long series of personal, conscious choices the student will make his/her own course from the basis material that the correspondence course offers. (LJOSÅ & SANDVOLD, 1976, p. 19)

The following discussion will in part be based on the paper of Ljosà and Sandvold, in spite of the fact that they do not explicitly link up with Rogers lines of thought.

14.2 The design of the teaching material

According to LJOSÅ & SANDVOLD (1976) it is possible, within the correspondence course material, to allow the students to choose between partially different curricula

- on various levels, and/or
- along personal interests.

These variations could be made possible by means of material worked into the actual course. However, the student could also receive instructions aimed at helping him to

- choose supplementary material on his own (e.g., in literature of the fiction or non-fiction area, in newspapers, radio or TV)
- find learning material and applications in his own environment.

(Actually, such instructions are already included in a good deal of correspondence courses.)

The students' choice can be more or less controlled by the course writer's/editor's directions. The optional material can also be more or less structured for learning.

The student's freedom can obviously be considerably extended by the kinds of measures proposed by LJOSÅ & SANDVOLD (ib.), even if a more or less

comprehensive course core is still assumed to be compulsory.

Nevertheless, it appears possible to further extend the student's freedom without having to break completely the boundaries of correspondence education. At least in courses that are not aimed at preparing for an examination, the teaching material could consist *solely* of optional subject matter plus numerous references to optional supplementary materials, and suggestions for applications.

Both ways of extending the students' freedom within the framework of the teaching material – the former, somewhat more conservative way described by Ljosá and Sandvold, and the latter, more radical way – would of course imply consequences for the two-way communication in correspondence education.

14.3 The functions of two-way communication at a distance

14.3.1 Postal two-way communication

As LJOSÁ & SANDVOLD (1976) point out, correspondence students can be offered a certain freedom by providing options as regards the *assignments for submission*, even in those cases where all the course material is obligatory. Actually, such options are provided in a considerable number of correspondence courses. In addition, assignments for submission can of course be based on optional teaching material.

The freedom of choice with regard to assignments for submission could however be further extended. The students could be allowed to try to solve problems which they have designed themselves – thus, completely *»open»* assignments for submission:

> . . . we must also consider the possibility that the student himself/herself formulates his/her assignments, giving the reasons for the choice. The tutor's task then, will be to give comments and to guide the student in accordance with his/her special choice. One condition, perhaps, is that the course is not exam oriented. (LJOSÁ & SANDVOLD, 1976, p. 32)

Another possible way would be to introduce what could be called *»reverse»* assignments for submission, i.e. to let the students ask questions to the tutor – instead of the reverse, which is the traditional and, by far, most common way:

> It is imaginable that . . . the students initiate communication, for instance by asking questions, or selecting study matter from a varied offer in the subject, by requesting guidelines and exercises etc . . . Steps in this direction would be welcome as they could act as serious applications of the principle of learner-controlled study . . . (HOLMBERG, 1974, p. 41)

Considering the strongly directing influence on the study work generally exerted by tests and test-like situations (SÄLJÖ, 1975), such »open» and »reverse» assignments for submission might offer the best opportunities to apply Rogers' humanistic non-directive teaching model to correspondence education.

Whether the students' freedom of choice is made more restricted or is almost absolute, the *role of the correspondence tutor* has become markedly changed:

> The evaluation of the fixed assignments is not any longer the tutor's most important task. The tutor functions to a larger degree as study guide and partner in a dialogue between him/her and the student. This asks more of the tutor's imagination and understanding. (LJOSÅ & SANDVOLD, 1976, p. 52–53)

Thus, in this free kind of correspondence education the tutor will be more of an advisor and discussion partner than in conventional correspondence study. This implies, in turn, certain demands on the relationship between learner and »facilitator» – demands which could be expressed in the Rogerian terms: »realness», positive valuing of other people, and empathy.

14.3.2 Postal two-way communication supplemented by simultaneous contacts

Thus, it would appear quite *possible* to make pure correspondence education a means of realizing Rogers ideas of »freedom to learn». It can, however, hardly be in doubt that the learning of distant students could more easily and naturally be facilitated by supplementing the postal two-way communication with simultaneous contacts.

Rogers model demands the greatest possible flexibility from the teaching institution. It should be able to adapt to the students' individual learning requirements. This in turn creates the need for many different kinds of resources. One resource could be opportunities to use **computer-assisted distance education on line** for short instructional programmes in subject matter areas where the student himself experiences a need for step by step guidance until, e.g., a basic skill is well mastered.

Opportunities to utilize various forms of telephone teaching would be of even greater value. The form of telephone teaching called **dial-access** would be particularly appropriate, since Rogers places a strong emphasis on the student's own knowledge-searching activities. By dial-access is denoted

> . . . an information system that provides a person with brief summaries on different topics. The summaries are recorded on tape and available by dialling an operator or computer . . . Most dial-access systems operate in connection with libraries. (FLINCK, 1975a, p. 13)

No doubt, **telephone tutoring** would also be suitable when trying to apply Rogers teaching model to correspondence education. It is true that many problems can be treated, without serious difficulties, by letter. But in several cases, a discussion can be carried through much more smoothly – and, of course, more rapidly – by telephone. Moreover, some people simply like communicating by telephone better than by means of paper and pencil. (It should of course be noted that the reverse is also true!) Telephone tutoring could also be an excellent supplement to the postal communication in order to facilitate the establishment of a near relationship between student and correspondence tutor.

Telephone tutoring devised according to Rogers teaching model would imply that students be allowed to call their tutor, as well as the reverse. (Cf. the design of the FLINCK, 1976a, study.)

Telelecture might be another resource for students who feel a need of taking part in group meetings.

During **face-to-face sessions** in groups, the process should be – as far as possible – student-directed (even the telelectures, if any). That is, they should be of the type »learner-controlled guidance» (cf. FLINCK, 1975b, p. 11). The group sessions could primarily be used for discussions of the students' choices of individual curricula etc. and for help with individual difficulties. In the study hall, or connected to it, there should be a well-supplied library with various types of instructional materials, materials intended for general information etc. As far as possible, not only printed but also audiovisual materials should be available.

Provided that the correspondence tutor is identical to the tutor at the group meetings, these face-to-tace sessions could also be valuable from the relational point of view. *Individual* face-to-face contacts would be of even greater importance in this respect. In addition, such contacts – at the distant teaching institution, at a regional or local study center, or in the student's home – would be the best form for discussions of the student's learning goals and of the evaluation of his study results.

When applying Rogers model it would be desirable – to a higher degree than would be the case with the other models – that a *great deal* of the conceivable resources for simultaneous contacts were made available to the students – if possible, *without binding* them to any of these kinds of two-way communication.

14.4 Rogers model applied to correspondence education – a summary review

Among all the models dealt with in this study, Rogers model leads to the weakest emphasis on the *teaching material* in correspondence education, although a good deal can be made by means of such material in order to provide the students options with regard to subject matter content, study level, way of studying, etc.

Correspondingly greater demands are made on the two-way communication. In the *postal contacts*, the assignments for submission can very well be of an »open» and/or »reverse» type. The correspondence tutor's main task would then be to guide and give advice, not to control and assess. In trying to perform this task, he must pay a particularly great attention to the establishment of good emotional relations with the students.

In these efforts, the telephone, in the form of individual *telephone tutoring*, can be of very good help. *Group meetings* and, to a still higher degree, *individual face-to-face contacts*, could fulfil the same functions for students wanting such forms of communication.

When applying Rogers model, the resources available to the students should be as varying and as flexible as possible. Among such resources, short programmes for *computer-assisted distance education on line* could be considered, as well as telephone teaching of the *dial-access* and *telelecture* types, and a well-supplied library containing not only printed but also audiovisual materials.

15 Gagné's general teaching model

15.1 Introduction

The teaching model which has been gradually developed by GAGNÉ since the appearance of the first edition of »Conditions of learning« (1965), can be regarded as a comparatively general model. It claims

1 to be applicable to *all »varieties of learned capabilities«* (GAGNÉ, 1977) *or »domains of learning«* (GAGNÉ, 1972). In later versions of his model, GAGNÉ (1975, 1977) considers five major domains or varieties: motor skills, verbal information, intellectual skills, cognitive strategies, and attitudes. However, the emphasis of his model is on the intellectual skills (GAGNÉ, 1976, p. 42)

2 to include a *complete and universally applicable sequence of instructional phases*, which closely correspond to the natural sequence of learning phases

3 to be applicable to *various kinds of teaching* – oral classroom teaching as well as instruction by means of written material or other media (GAGNÉ, 1977, p. 283) – in *various educational contexts*: schools, vocational training programmes, or courses for adult education (ib., p. 287).

Gagné's view of teaching was originally based on ». . . a combination of the neo-behaviorist psychological tradition and the task analysis model that dominates the fields of military and industrial training« (SCHULMAN, 1972). Later versions of his model are however linked up with a general learning model which has been derived from contemporary information-processing views of learning. In his discussion of various components of the model, Gagné in addition draws not only on behaviouristic but also on cognitivistic research. Thus, also in this respect, Gagné's teaching model seems to aim at a comparatively high degree of generality.

Occasionally, Gagné refers explicitly to Skinner, Rothkopf, Ausubel, and Bruner (see, e.g., GAGNÉ, 1977). From Gagné's point of view, the teaching models developed by these researchers could be regarded as emphasizing certain traits of Gagné's own model. Even Egan's structural communication model should be possible to express in Gagné terms. The same might be applicable to Rogers model. (For a more detailed discussion, see section 15.4.)

15.2 View of learning

15.2.1 An information-processing model of learning

Process theories of learning start from an analogy between man and computer – or, to be precise, between man's cognitive functions and a computer programme. Such theories pay particular attention to those learning processes which are supposed to take place between information »input« and »output«.

Therefore, cognitivistically oriented researchers in particular have taken an interest in information-processing models of learning (e.g., NEISSER, 1967; cf. HILGARD & BOWER, 1975, p. 430). On the whole, this approach and related theories appear to provide a considerable stimulus to contemporary learning research (GREENO & BJORK, 1973; COTTON, 1976).

The particular information-processing model of learning and remembering which Gagné takes as his starting-point is shown in *figure 4*.

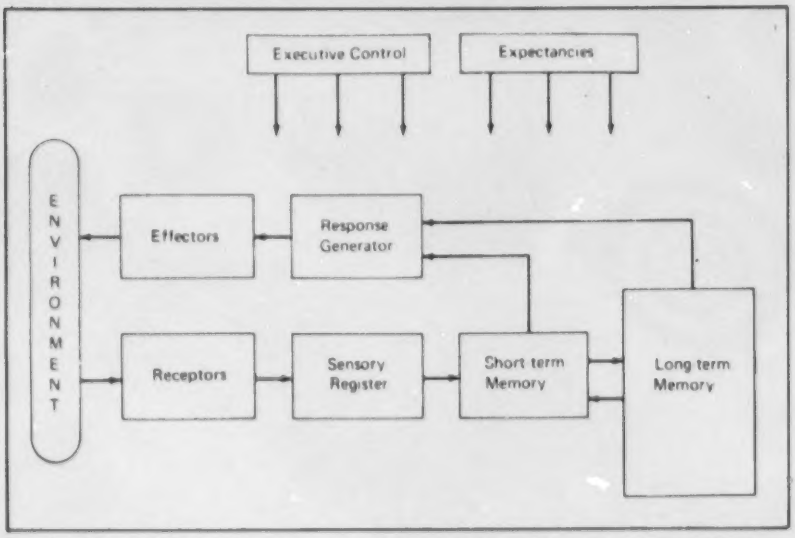

Figure 4. A basic information-processing model of learning and remembering, according to GAGNÉ (1977, p. 53)

The model illustrates the information flow from input to output. Stimulation from the environment affects the sense organs – the receptors – and reaches the nervous system via a *sensory register*. Here the information is »registered« but is kept in a relatively intact form for only a fraction of a second. By selective perception, attention is paid to only certain parts of the information. These parts are carried over to the *short-term memory*. The storage capacity of the short-term memory is clearly limited, and it can therefore be regarded as a kind of »working memory«. All information that we attend to at all, has to be processed in the short-term memory. Such information that will be retained for later use is coded for storage in the *long-term memory*, from which it can be retrieved into the short-term memory, when required. Output is made possible by means of a *»response generator«*, which transforms the information to action via effectors (muscles).

In addition, the model indicates the internal control of the information flow. The *executive control* – consisting of cognitive strategies – and other control processes, called *expectancies*, activate and modify the information flow. They affect attention and selective perception as well as the choice of the actual information that will be transferred to the long-term memory. They determine which encoding schemes will be used and how the information will be searched for in the long-term memory. They also affect how the responses will be given.

These control processes are, to a great extent, learned and therefore constitute an actual part of the long-term memory.

Another key concept in the information-processing view of learning is *feedback*. A response often leads to a number of consequences, which are perceived by the individual and used as supplementary information – information about how well the original information has been processed. Thus, the feedback either confirms for the individual that he is on the right track, or offers him a hint regarding how the internal process (and the resulting external behaviour) should be modified.

• Starting from the learning model, Gagné distinguishes eight phases in a typical »learning act», corresponding to the internal processes implied in the learning model. See *figure 5*.

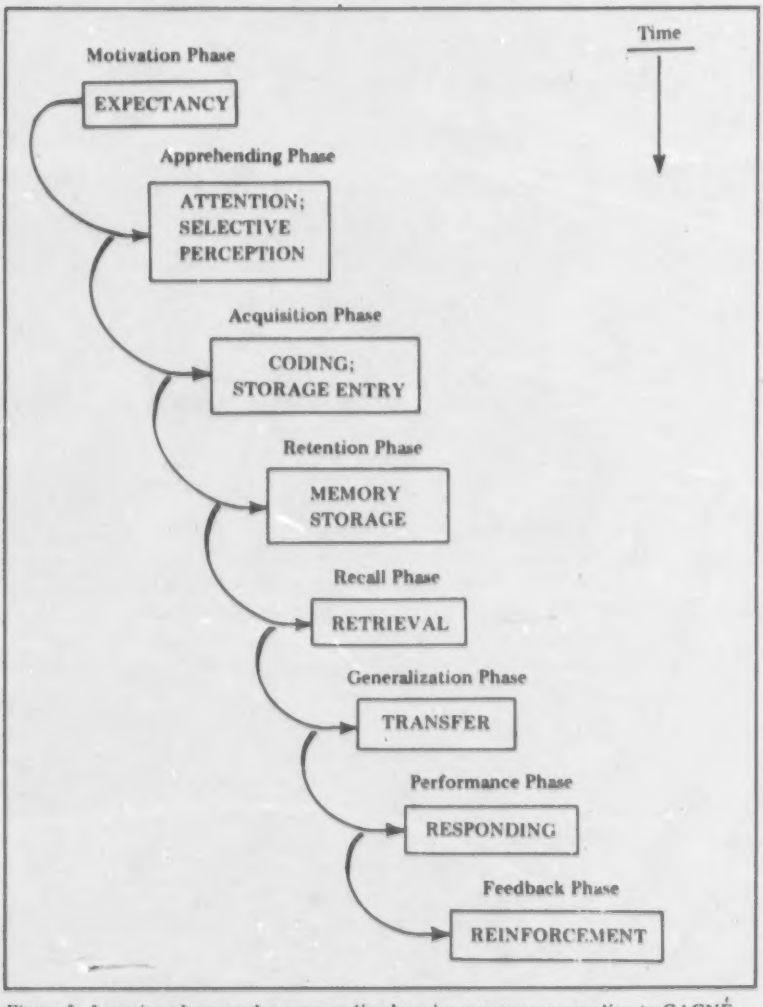

Figure 5. Learning phases and corresponding learning processes, according to GAGNÉ (1975, p. 28)

Thus, in order that learning can take place, some form of motivation is usually required, which in turn creates expectancy. The individual must further attend to relevant parts of the total stimulus situation, and make a selective perception of these parts. After that the message will be coded and stored in the long-term memory. It must, however, be possible to retrieve it again from the long-term memory. What is learned should also be generalized, i.e., be made transferable to new situations. In addition, by giving responses the individual gets the opportunity to obtain feedback.

15.2.2 Various types of learned capabilities or domains of learning

According to Gagné, learning is influenced by different conditions, internal as well as external. By *internal* conditions of learning is meant, primarily, »the contents of the long-term memory accessible to the learner« (GAGNÉ, 1977, pp. 257–258) – i.e., already established knowledge, skills, and attitudes. Gagné attaches great importance to these internal conditions (although, in his works, he has mainly dwelt on the external ones).

From what has now been said follows that, to Gagné, learning is an *active* process. To encode new information, the individual must always search in his long-term memory for connections. The information cannot become the individual's property until he has discovered an appropriate »mediator« between what he already knows and the new message. In this sense, it would be justified to say that » . . . discovery learning . . . is practically a synonym for 'learning'« (GAGNÉ, 1967, p. 27). According to Gagné, this applies to rote learning, as well as to meaningful learning.

The external learning conditions can be planned and arranged so as to activate and facilitate the learning processes. Such planned and arranged external conditions of learning are called *instruction* by Gagné.

However, the optimal learning conditions vary, in part, with different types of learning tasks. According to GAGNÉ (1972, 1977) it is possible to distinguish – besides certain »basic forms of learning« (classical conditioning, instrumental learning, etc.), which are supposed to be included in the higher level learning forms as components – five domains of learning or varieties of learned capabilities. Three of them are cognitive, whereas the fourth can be described as affective and the fifth as psychomotor. Gagné's latest taxonomy looks like this (the order between the five domains is of no importance, according to Gagné):

1 Verbal information

2 Intellectual skills
2.1 Discriminations
2.2 Concrete concepts
2.3 Defined concepts
2.4 Rules

3 Cognitive strategies

4 Attitudes

5 Motor skills

Verbal information includes learned names and facts as well as learned sets of interrelated facts.

If verbal information concerns »knowing what», *intellectual skills* refer to »knowing how». As far as teaching is concerned, the most important subcategory of intellectual skills is »rules», e.g., mathematical and linguistic rules. (What matters here is to be able to *follow* the rules – not to be able to formulate them, which is a task within the verbal information category.) The mastering of rules implies however the mastering of different kinds of concepts, which in turn implies discrimination.

Cognitive strategies are described as

> . . . internal processes of *executive control* . . . They are skills with which learners regulate or modulate their internal processes of (1) attending and selective perceiving; (2) coding for long-term storage; (3) retrieval; and (4) problem solving. (GAGNÉ, 1977, p. 167)

In contrast to the intellectual skills, which are oriented towards the *environment*, the cognitive strategies control the *individual* in his dealing with the environment. They are related to our general ability to search and make use of information, and they include learning strategies and problem solving strategies, including strategies for creative problem solving.

By *attitudes* Gagné denotes learned dispositions which tend to affect our behaviour towards things, events, or living beings. An important class of attitudes refers to our relations to other people. Therefore, when dealing with the teaching of attitudes, Gagné also considers arrangements of conditions for *social learning* (i.e., learning of social attitudes).

By *motor skills* is meant not only physical activities but also such motor activities that combine with intellectual skills, e.g., when speaking, writing, or playing an instrument.

15.3 View of teaching

15.3.1 An educational technology-oriented approach

Gagné's basic view of teaching can be described as educational technology-oriented. He recommends a systematic planning of teaching, in three steps: (1) goal description (or, to use Gagné's term, »task description»), (2) learning analysis, (3) deriving the external conditions of learning – i.e., planning the proper teaching measures (GAGNÉ, 1977, chapter 11).

The *learning goals* or learning tasks should be described in as detailed a manner as is necessary in order to prevent misunderstanding. (Cf. e.g., the traditional educational technology recommendations concerning the use of verbs denoting observable behaviours, like »identifies», »distinguishes between», »chooses», etc.)

The *learning analysis*, in turn, contains several components. The determination of the variety/varieties of capabilities required for the learning task – i.e. the final goal of the learning – is of basic importance. It is also necessary to analyse the particular basic skills, pieces of information etc. that must be mastered before the work on the actual learning task can begin. These prerequisites can be viewed as sub-goals or sub-tasks. As far as intellectual skills

are concerned, the prerequisites can be arranged in learning hierarchies, which lead, step-by-step, to the final goal.

If the learning analysis is combined with a learner analysis, the teacher/teaching institution can, for each individual student, determine at what level instruction should start (GAGNÉ, 1977, pp. 274–275).

The student's learning efforts should be *evaluated* by means of goal-related tests, which provide immediate measures of goal-attainment (GAGNÉ & BRIGGS, 1974, chapter 9). Particularly with regard to goals of the verbal information, intellectual skills, and motor skills varieties, a »mastery learning»-approach (BLOOM, 1971) is recommended by Gagné. Which types of test items can be used (e.g., multiple-choice questions or essay questions) depends on how the learning goal is defined.

15.3.2 Instructional events

With his learning model and his division of learned capabilities as a frame of reference, Gagné investigates which external conditions promotes learning – i.e., how teaching should be carried out.

Gagné's teaching model includes eight – or, possibly, nine – steps, called *instructional events* (the two last steps are brought together by Gagné to one event):

1 Activating motivation
2 Informing learner of the objective
3 Directing attention
4 Stimulating recall (of relevant prerequisites)
5 Providing learning guidance
6 Enhancing retention
7 Promoting transfer of learning
8 a Eliciting performance
  b Providing feedback

(GAGNÉ, 1977, chapter 12).[1)]

The order between the »events» has not necessarily to be that presented here (ib., p. 299). It is however far from arbitrary, since it parallels the typical sequence of learning phases which has been previously described (*figure 5*, 15.2.1). The relation between learning phases and instructional events is illustrated in *figure 6*.

1) Readers who are well acquainted with previous versions of Gagné's teaching model probably discover a number of differences, although the basic structure is the same. A seemingly strange feature of the latest version is that Gagné has excluded the presentation of the very learning material – »presenting the stimuli inherent to the learning task» (GAGNÉ, 1970, p. 304). To all appearances, these stimuli are implied as constituting the learning material to which attention is directed in step 3.

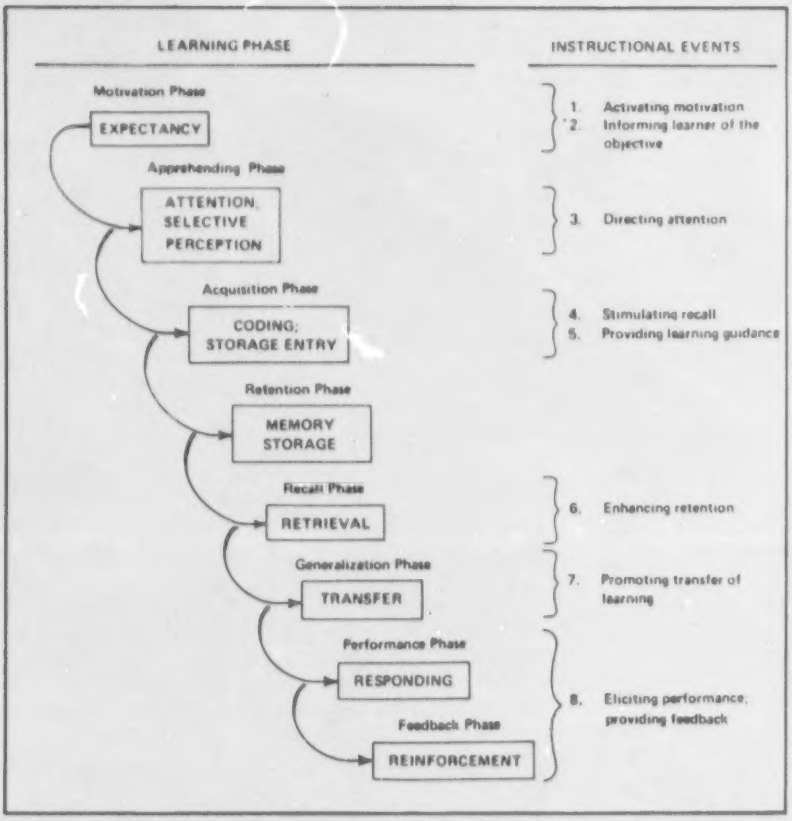

Figure 6. The relation between learning phases and teaching functions (»instructional events»), according to GAGNÉ (1977, p. 285)

(1) Activating motivation. As we have seen, expectancy is in the learning model regarded as a control process, which affects the total flow of information from the attending of certain details to the organizing of behavioural responses. Expectancy can be viewed as the learner's specific motivation to attain the learning goal (GAGNÉ, 1977, p. 61).

This expectancy can be influenced by measures which, in a more general way, are aimed at activating the student's learning-relevant *motives* – e.g., curiousity or exploration motive, and competence or achievement motive. Typical measures of this kind are attempts at stimulating the student's interest, e.g., by presenting – at the beginning of an instructional sequence – a problem which both arouses the student's curiosity and challenges his competence or achievement motive.

(2) Informing learner of the objective. According to Gagné, the second type of instructional events co-operates closely with the first one. Since it is desirable that the student receives an expectancy which can optimally contribute to the internal control of the information process, the teacher or the textbook (etc.) should inform the student in a comprehensible and stimulating way of what he is expected to be able to achieve after learning.

(3) Directing attention. Two types of attention are distinguished by GAGNÉ (1977). The first is a general *alerting function*, which serves to make the organism prepared to receive stimuli (in order that they reach the sensory register, cf. section 15.2.1). In teaching, sudden stimuli changes can serve this purpose.

The second type of attention is *selective perception*, by which the learner chooses which information will be carried over to the short-term memory. In teaching, selection of learning-relevant stimuli can be facilitated by means of accentuations and pauses in speech, and underlinings, italics, and lay-out arrangements in writing.

(4) Stimulating recall of relevant prerequisites. The coding of material from the short-term memory for storage in the long-term memory is regarded by GAGNÉ (1977, p. 54) as the most critical part of the learning process. Here, the teacher can assist, in the first place, by helping the student to *recall* relevant previous knowledge (previously acquired skills, etc.).

If students lack necessary prerequisites, the teacher must of course arrange external conditions for helping the students to *learn* them (by utilizing all eight steps, or as many of them as are found to be indispensable).

(5) Providing learning guidance. Another kind of teaching measure aimed at facilitating transfer to the long-term memory, is giving direct guidance for coding of the information. As regards the learning of verbal information, guidance can consist of providing a meaningful context within which the new material can be related – e.g., by linking up the new information with the students' own experience. If, on the other hand, it is a question of learning a rule, the students can be given suggestions of how sub-ordinate rules should be co-ordinated to arrive at the new rule.

The guidance can take the form of statements, questions, or various kinds of illustrations (pictures, diagrammes, etc.). GAGNÉ (1977, pp. 295, 308–312) maintains that the most important function of pictures in teaching is to facilitate encoding – and retrieval – of the information to be learned:

> Pictures add many valuable features to instructional events . . . Their function in supporting *encoding* and *retrieval* functions is considered critical. Their operation is conceived as one of generating *specific retrievable images* in the learner, which in turn constitute a means of encoding and memory storage, and a source of cues for retrieval of what has been learned. (GAGNÉ, 1977, p. 312)

(6) Enhancing retention. Retention of the learned material is furthered by distributed reviews, if possible with varying examples (GAGNÉ, 1975, p. 115). Different kinds of »cues for retrieval» (GAGNÉ, 1977, p. 296) are also most valuable in facilitating retrieval. Such cues can, e.g., consist of the arrangement of the learning material – in the form of tables, diagrammes, pictures, etc. (Concerning the function of pictures, not only with regard to the encoding but also the retrieval of information, cf. the quotation in the preceding paragraph.)

(7) **Promoting transfer of learning.** Generalizing what has been learned, or – in other words – the ability to apply what has been learned to new situations, is promoted by measures aimed at transfer of learning. According to Gagné, such measures consist primarily of giving

> . . . a *variety* of features of the learning task, as well as a variety of contexts in which the learning occurs. The more broadly based a learned capability, the better chance that it will have to transfer to new and different situation. (GAGNÉ, 1977, p. 296)

Consequently, to the extent that the learned matter is trained in as widely varying situations as possible, its usefulness will probably increase.

Group discussions can be an excellent means of promoting transfer. This requires, however, that the participants have learnt the basic facts, skills, etc. tolerably well – which is, according to Gagné, regrettably seldom the case (GAGNÉ, 1975, p. 129).

(8a) Eliciting performance. The outcome of learning should be demonstrated in one way or another, in order that the teacher and/or the student himself can assess whether the learning objective is attained. This demonstration can of course be made earlier in a teaching sequence (before functions 6 and 7; GAGNÉ, 1975, p. 117). However, waiting until the end of a whole series of teaching sequences or teaching acts is definitely not recommended:

> . . . while tests have several important functions in programs of instruction, they are not substitutes for the elicitation of performance which occurs as an end-point in the learning act. The immediate performance of the learner can best be observed by an instructor, or by the learner himself, on an occasion which permits the natural and smooth completion of a sequence of learning processes. (GAGNÉ, 1977, p. 297)

(8b) Providing feedback. The providing of feedback to the student is closely connected to the eliciting of performance (8a). If the feedback gives positive information – i.e., tells the student that he has attained the learning objective – it functions as a fulfilment of the expectancy existing or created at the beginning of the learning act. In this way, feedback produces *reinforcement*, according to GAGNÉ (1977, pp. 57, 297).

Of course, feedback need not always be given explicitly, by means of confirming or correcting words. Sometimes the situation or the context provides, in itself, (implicit) feedback.

15.3.3 Teaching and various domains of learning or varieties of learning outcomes

GAGNÉ (1977) devotes a great deal of space to the different varieties of learning outcomes (learned capabilities, domains of learning, classes of learning objectives) and those external conditions – i.e., teaching measures – especially apt at promoting each of these varieties. The idea is that, for each variety, there are certain particularly important or »critical» external learning conditions.

A survey of such critical external learning conditions is provided in GAGNÉ (1975). It is shown in *table 2.*

Table 2. External conditions which can critically affect different varieties of learning outcomes (GAGNÉ, 1975, p. 93)

Class of Learning Objective	Critical Learning Conditions
Verbal Information	1. Activating attention by variations in print or speech 2. Presenting a meaningful context (including imagery) for effective coding
Intellectual Skill	1. Stimulating the retrieval of previously learned component skills 2. Presenting verbal cues to the ordering of the combination of component skills 3. Scheduling occasions for spaced reviews 4. Using a variety of contexts to promote transfer
Cognitive Strategy	1. Verbal description of strategy 2. Providing a frequent variety of occasions for the exercise of strategies, by posing novel problems to be solved
Attitude	1. Reminding learner of success experiences following choice of particular action; alternatively, insuring identification with an admired »human model« 2. Performing the chosen action; or observing its performance by the human model 3. Giving feedback for successful performance; or observing feedback in the human model
Motor Skill	1. Presenting verbal or other guidance to cue the learning of the executive subroutine 2. Arranging repeated practice 3. Furnishing feedback with immediacy and accuracy

15.3.4 Self-instruction

GAGNÉ (1967, p. 29) pretends that learning is not, in any essential meaning, »an event of *social* interaction«. Learning is »an *individual* act« (ib., p. 30). This does, of course, not conflict with the fact that most people need some sort of help in learning. However, different students need different amounts and kinds of help. For example, children and adults are often markedly different with regard to

- the store of previously acquired verbal information available as meaningful context when learning new information
- previously acquired intellectual skills available as a basis for building new skills
- developed cognitive strategies

and probably also

- attitudes and motor skills (GAGNÉ, 1972).

In passing, GAGNÉ (1977, pp. 301–302) touches the question of self-instruction. In particular, adult learners with long experience of studying have, in many cases, developed own »strategies for self-instruction». They can partially – or wholly – arrange their external conditions of learning themselves. Gagné thinks that these strategies for self-instruction are dependent on well-developed executive control functions, i.e., cognitive strategies (ib., p. 167).

GAGNÉ (1975) gives a summary comparison between group teaching and self-instruction in terms of his model. In doing so, he also includes individual tutoring. See *table 3*, p. 91.

As a matter of fact, one essential goal of all teaching is that the students eventually become independent learners, who – to a considerable extent – manage without help of any teacher (GAGNÉ, 1975, p. 120; cf., e.g., SKINNER, 1968, p. 144; BRUNER, 1966, p. 53). In practice, most students have of course not yet attained this goal. It is therefore an essential task for the teacher/the study organizer to determine, with respect to each study group – and, if possible, each student – how much learning help (i.e., instruction) is needed.

In this matter, GAGNÉ (1975) gives some general advice referring to each of the eight events of instruction. He considers no. 2 (informing learner of the objective), no. 7 (promoting transfer of learning), and no. 8 (elicting performance, providing feedback) as – most often – important and valuable. How much can be left to the students themselves with regard to the remaining instructional events, depends above all on the students' initial motivation and study skills:

> 1. *Activating motivation* can be omitted as an event when the motivation of learners is obviously high or when the lesson ties in with known student motivations. For much of instruction, though, it is an event of high importance.
>
> 2. *Informing the learner of the objective* of a lesson is almost always a good idea, except when the objective is already apparent.
>
> 3. *Directing attention* can often be done very simply. Sometimes, special pp. 121–122)
>
> 4. *Stimulating recall* may not be necessary for skillful self-learners; for others, however, it may be a critical event.
>
> 5. *Providing learning guidance.* This event may also be omitted when skill in self-instruction can be relied on.
>
> 6. *Enhancing retention.* Provisions for this event need not be made for highly skillful learners. Others, not so skillful, may need to be reminded to practice retrieval.
>
> 7. *Promoting transfer* is almost always a useful event, since it confronts the learner with novel situations that he may be unable to devise by himself.
>
> 8. *Eliciting performance, coupled with feedback* can be omitted for only the most skillful self-learners. It is this event which completes the learning, and to omit it would be a serious mistake. (GAGNÉ, 1975, pp.121–122)

Table 3. Comparison between group teaching, individual tutoring and self-instruction with regard to instructional events (GAGNÉ, 1975, p. 132)

Instructional Event	*Group Instruction*	*Tutorial Instruction*	*Individual Learning*
Activating Motivation	Teacher establishes common motivation	Tutor discovers individual motivation	Student supplies own motivation
Informing Learner of Objective	Teacher communicates objective to group	Tutor communicates objective to student	Student confirms or selects objective
Directing Attention	Teacher stimulates attention of group members	Tutor adapts stimulation to student attention	Student adopts attentional set
Stimulating Recall	Teacher asks for recall by group members	Tutor checks recall of essential items	Student retrieves essential items
Guiding Learning	Teacher provides hints or prompts to group	Tutor provides guidance only when needed	Student supplies own strategies
Enhancing Retention	Teacher provides retrieval cues to group	Tutor encourages student to use his own cues for retrieval	Student supplies own retrieval cues
Promoting Transfer	Teacher sets transfer tasks for all members	Tutor sets transfer tasks adapted to student capabilities	Student thinks out generalizations
Eliciting Performance	Teacher uses a test to assess performances of group members	Tutor asks for performance when student is ready	Student verifies his own performance
Providing Feedback	Teacher provides feedback to students, varying in immediacy and precision	Tutor provides accurate and immediate feedback	Student provides own feedback

15.4 Summary of the model

In its latest version, Gagné's teaching model is explicitly based on an *information-processing model of learning*. Teaching is viewed as systematic arranging of those external conditions which can affect the learning processes. On the whole, planning, systematics, and effectivity are regarded essential. Gagné's model can therefore be characterized as educational technology-oriented. (Cf. GAGNÉ & BRIGGS, 1974, where this orientation stands out most clearly.

Teacher and student activities are closely related to the learning model and parallel the typical learning sequence which has been derived from this model. The activities are aimed at creating motivation (expectancy) and attention to relevant stimuli, and at facilitating encoding of information, retention, retrieval, generalizing, and feedback.

The eight teaching functions or *instructional events* are assumed to be differentially important to various *domains of learning* (varieties of learned capabilities or learning outcomes, classes of learning objectives): verbal information, intellectual skills, cognitive strategies, motor skills, and attitudes. Their importance also varies between different students, depending on which strategies for self-instruction the students have developed.

Gagné does not discuss the students' opportunity to influence the learning goals or learning objectives. The basic model appears to imply a fairly high degree of teacher control. Nevertheless, thanks to its flexibility, Gagné can apply it even to self-instruction. The teacher control is, in this case, simply transformed to learner control. Whether the control is external or internal, it is still supposed to be fairly strict. An appropriate term to describe this feature of the model might be *comparatively firm structure*.

The special resources required by the model refer primarily to personnel. Teachers/study organizers should be well trained in various kinds of analyses typical to the educational technology approach (goal and content analyses, student analysis, etc.).

Gagné assumes that his model is *generally applicable*. It is based on a general learning model and considers all main varieties of learning goals or »learning outcomes». It is also supposed to cover all essential teaching functions. In the model, these functions or »instructional events» are related to learning phases (according to the learning model), as well as to learning outcomes. Cf. *figure 7*.

Gagné considers that, owing to this universal applicability, his model can be used for various forms of teaching (e.g., oral and written) at different levels and in different educational contexts.

15.5 Gagné's model related to previously discussed models

Gagné thinks that most of the views of learning and teaching dealt with in preceding chapters are, in all essential respects, compatible with his own general model. The differences would mainly lie in the *concentration on different domains of learning* (learning outcomes, etc.) and the *emphasis on different teaching functions* (events of instruction) (GAGNÉ, 1976).

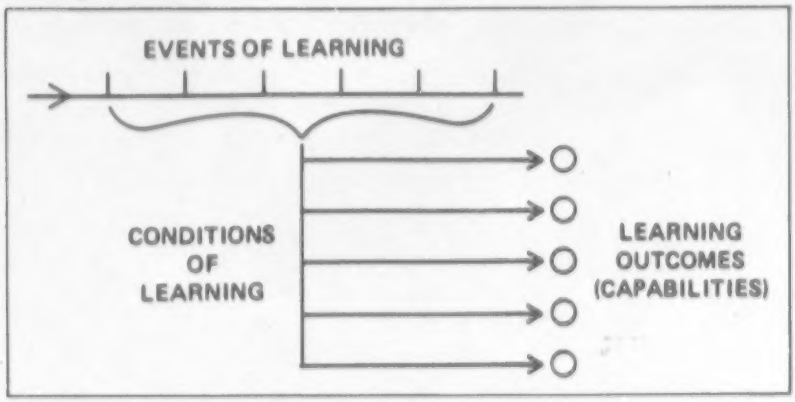

Figure 7. The relation between learning phases (»events of learning«), learning outcomes and conditions of learning (which include internal as well as external conditions; the »events of instruction« belong to the external conditions of learning). From GAGNÉ (1977), p. 21

For example, according to Gagné, *Skinner* emphasizes the first and the last two teaching functions (i.e., the motivation, response, and feedback functions). On the contrary, *Ausubel* concentrates on the intermediate functions, in particular those four which refer to the long-term memory (stimulating recall of relevant prerequisites, providing learning guidance, enhancing retention, and promoting transfer of learning).

Bruner is primarily interested in learning outcomes of the type which are called, by Gagné, cognitive strategies (although he also attaches great importance to intellectual skills) – i.e., the processes by means of which the individual controls his attention, his learning, and his thinking. Something similar might be said about *Egan*, although Gagné does not discuss his model.

According to Gagné (1977, pp. 35, 60), *Rothkopf's* concept »mathemagenic activities« could also be related to cognitive strategies. However, the purpose of mathemagenic activities is, according to Rothkopf, to attain specific learning goals. The intended goals seem primarily to be of the verbal information and intellectual skills varieties, as in Ausubel's model.

Rogers model is not discussed by Gagné. Nevertheless it appears, at least with regard to certain parts, possible to interpret in Gagné terms. Like Bruner, Rogers has concentrated on cognitive strategies, by means of which students can control their own searching for knowledge. When students practise independent learning, they take themselves, completely or partially, over those teaching functions that are otherwise fulfilled by a teacher or an instructional material (cf. *table 3*, 15.3.4). – It is, however, apparently more difficult to describe the relationship between »facilitator« and learner, recommended by Rogers, in terms of the Gagné model.

Although Gagné's model has certain behaviouristic features, is educational technology-oriented, and concentrates on intellectual skills to a comparatively high degree, it is nevertheless sufficiently general in its design to make it possible to interpret – at least partially – the other models in Gagné's terms.

16 Gagné's model applied to correspondence education

Certain parts of an earlier version of Gagné's teaching model (GAGNÉ, 1970) have already been utilized by AHLM (1972), BÅÅTH (1974, 1976b), FRITSCH (1974), LAMPIKOSKI & MANTERE (1976), the West-German Bundesinstitut für Berufsbildungsforschung (*Aufgaben im Rahmen von Lehr-Funktionen im Fernunterricht*, 1977), and the Norwegian Brevskolerådet (*Veiledning for brevskolekerere*, 1977) in works aimed at developing correspondence teaching or otherwise related to distance education. For the same purpose, LOVE (1977) and BÅÅTH (1978b) made use of a later version of the model (GAGNÉ, 1975, and 1977, respectively).

The emphasis in all these cases has been on one part of Gagné's model – the teaching functions (»events of instruction»). AHLM (1972) used these functions to identify the needs for telephone tutoring in connection with correspondence study. By the Bundesinstitut für Berufsbildungsforschung, the same functions were taken as the starting-point of an analysis of assignment questions and self-test exercises in correspondence education (*Aufgaben im Rahmen . . .*, 1977).

BÅÅTH (1974) compiled a »list of ideas» for the construction of correspondence course material, starting from a slightly modified version of the Gagné »events». The same version was the basis of an extensive question to European correspondence schools about the functions of assignments for submission (BÅÅTH, 1976b), as well as of the guidelines for correspondence tutors compiled by the Norwegian Brevskolerådet (*Veiledning for brevskolekerere*, 1977). Another somewhat modified version was utilized by LAMPIKOSKI & MANTERE (1976) as a framework for an extensive collection of didactic principles with the purpose of facilitating an analysis and development of distance education – particularly correspondence education. BÅÅTH (1978b) has recently provided an analysis of supervised correspondence study, based on the latest version (1977) of the Gagné model.

FRITSCH (1974) made use of Gagné's model in an empirical investigation which of the instructional functions could be »objectivated», i.e., provided for – wholly or partially – without face-to-face teaching. This investigation concerned West-German distance education projects at the university level. LOVE (1977) analyzed the contributions of »the print and televison media in correspondence study» in the light of the 1975 version of Gagné's teaching model.

16.1 Is it fundamentally possible to apply the model to correspondence education?

That Gagné's teaching model is, in principle at least, applicable to correspondence education follows only from the fact that it can be applied even to pure

self-instruction. As a rule, correspondence students are adults. Sometimes they can also be assumed to be initially highly motivated and to have good previous knowledge and techniques of study. In such cases it would be justified to hand over most of the work to the students themselves, which is typical of the »Material minus, dialogue minus» form of correspondence education, identified by BÅÅTH & WÅNGDAHL (1976). This type of correspondence teaching is not very far from self-instruction.

However, most correspondence students are, in all likelihood, not initially highly motivated and/or have not very good previous knowledge and well-developed cognitive strategies. Normally, correspondence courses must therefore not only present the actual information but also provide a considerable amount of *teaching* – i.e., external conditions favourable to the students' processing of the information.

When applying Gagné's model to correspondence teaching, the following factors should be considered in the first place (cf. Nilsen's definition, section 1.2).

- the physical *distance* between student and teaching institution/teacher
- the *two-way communication* maintained between these parties, in spite of the distance
- the fact that the two-way communication in correspondence education makes use of *stored information.*

The physical distance makes improvisations in teaching difficult, necessitating very careful planning. An educational technology approach – in the spirit of Gagné – to correspondence education (and to distance education on the whole) is therefore close at hand. (Cf. section 15.3.1.)

The degree of control in correspondence teaching is also, as a rule, comparatively high, which might appear natural, thinking of the physical distance and the difficulties of improvising and allowing students' initiatives caused by the distance (BÅÅTH, 1976a). Certainly, not least due to *two-way communication*, it is possible to reduce the extraneous control and to make correspondence education more open (LJOSÅ & SANDVOLD, 1976). However, the possibility of utilizing the two-way communication for this purpose is limited by the slowness of the dialogue between student and teaching institution/teacher. This slowness follows in turn from the fact that, in pure correspondence education, only communication by means of *stored information* (printed texts, audio cassettes, handwritten or typed letters, etc.) is used.

Thus, correspondence education seems to be fundamentally well suited to a more detailed analysis with the aid of Gagné's teaching model. We are now going to investigate the usefulness of correspondence teaching as regards various kinds of learning. After that, we will try to apply in greater detail the eight – or nine – teaching functions (»instructional events») to correspondence education.

16.2 To which kinds of learning goals is pure correspondence education suited?

A study of *table 2* (15.3.3) shows that it should be possible to attain learning goals of the **verbal information** kind by means of correspondence teaching.

Both critical external learning conditions stated suit instruction by means of stored information comparatively well. The students' attention can be activated by variations in print or speech (in the latter case, e.g., on an audio tape integrated with the text material). A meaningful context for effective coding of the information can, of course, also be presented by means of the printed, handwritten/typed, or recorded word.

The same applies to learning goals of the **intellectual skills** type. The teaching material as well as the tutor can – separately or in co-operation –

(1) stimulate the student to retrieve previously learned component skills from his long-term memory

(2) present verbal cues to the ordering of the combination of component skills

(3) provide occasions for spaced exercises and reviews

(4) use a variety of examples to promote transfer.

The external conditions stated by Gagné as critical for the learning of strategies for problem solving and other **cognitive strategies** could also be arranged within the framework of pure correspondence education. The verbal description of the strategies can, with advantage, be presented in written form. New, varied problems aimed at exercising the strategies to be learned can also be given in the same way.

The learning of **attitudes** by means of pure correspondence teaching appears however more problematic (cf. HOLMBERG, 1976; LOVE, 1977). GAGNÉ (1975, p. 93) distinguishes two principal forms of attitude learning: a »direct» and an »indirect» form. The direct one is based on *experience of own success* (or own failure); success tends to entail a favourable attitude to the activity (the situation, etc.) that has resulted in an experience of success, while a negative attitude tends to follow an experience characterized by failure.

The indirect form of attitude learning refers to *»modeling»* (BANDURA, 1969). One perceives the behaviour of a person – whether present or not, whether real or fictituous – with whom one identifies, and observes the consequences of the model's behaviour. If the consequences are favourable, one experiences »vicarious reinforcement». One tends then to adopt an attitude corresponding to the model's behaviour and, thus, to imitate (to »model») this behaviour.

For each of the two principal forms of attitude learning, Gagné gives three critical external learning conditions, which refer to the teaching functions no. 1 (motivation), 8 a, and 8 b (performance and feedback); see table 3, 15.3.3. The first of these – activating the students' motivation – constitutes ». . . a particularly critical feature in the learning of an attitude» (GAGNÉ, 1975, p. 88). However, it appears difficult – even though not impossible – to fulfil this condition in pure correspondence education.

The *course writer* hardly knows his future readers (listeners) sufficiently well to be able to remind them concretely of previous experiences of success. In many cases it would probably also be impossible for the author to select human models about whom he could be fairly sure that the students would identify with them. In both cases, the course writer must content himself with more general references.

The *correspondence tutor* might perhaps better fulfil this function in arranging the conditions of attitude learning. The condition is, however, that the tutor both is given the possibility of establishing personal relations with his students and, in addition, tries hard to do so (cf. BÅÅTH & WÄNGDAHL, 1976). Simultaneous contacts in connection with correspondence education – in the form of telephone tutoring or face-to-face contacts – would probably have a stronger effect on students' motivation.

As regards the remaining functions, critical for attitude learning – eliciting performance and providing feedback – it is advisable to distinguish between different kinds of attitudes. *Study attitudes*, e.g., attitudes to the course in question, to the subject – and, by this, also to various cultural manifestations – as well as to studies on the whole, can be expressed directly in the students' work with the correspondence course. The result of this work manifests itself, e.g., in the answers to assignment questions. The correspondence tutor provides feedback; in doing so, he can contribute to an experience of success – and, thus, to a favourable attitude.

The case is different with regard to many *social attitudes* – attitudes to co-operation, to solidarity, etc. In such cases, the performance and feedback phases cannot be performed within the framework of pure correspondence education, at least not as far as the *direct* type of attitude learning is concerned. As we have just seen, even *modeling* would be very difficult to use in pure correspondence education. Social behaviour could, however, be trained during group meetings and other forms of face-to-face contacts, arranged to supplement correspondence education.

If such supplementary face-to-face sessions are not included, the best solution is probably that the course material provides all material necessary for facilitating learning of the cognitive and – as far as possible – affective aspects of the attitude in question. To promote training of the behavioural aspect of the attitude, course writer and correspondence tutor must try to stimulate the student to make, *himself*, the newly acquired ideas (and the related emotions) lead to action. In addition, the student can be encouraged to discuss the attitude in question with, e.g., members of his family and/or with friends.

The possibility of teaching **motor skills** by means of pure correspondence teaching seem also to be limited (cf. LOVE, 1977). The »executive subroutine», i.e., the rule for the performance, ». . . which governs the number and sequence of actions that make up the performance» (GAGNÉ, 1975, p. 90), can be taught with the aid of text and/or picture(s) and/or oral instructions on audio tape. However, the *performance and feedback phases* cannot be provided for within pure correspondence education but in certain cases when the motor skill is closely connected with intellectual skills, as in writing, talking, playing music, etc. In such cases, performing the combined motor and intellectual skills can lead to a product, on which the correspondence tutor could give feedback.

In other cases of motor learning the critical performance and feedback functions must be provided for by supplementary face-to-face teaching – or be left to the student's self-instruction.

In summary, it would be possible to attain learning goals of the *verbal information, intellectual skills*, and *cognitive strategies* types by means of pure correspondence teaching. With regard to certain kinds of *attitudes* and *motor skills* it appears more difficult to arrange all of the external learning conditions considered critical by Gagné within the framework of such correspondence

education. However, supplementing correspondence study by face-to-face contacts should considerably increase the opportunity to achieve even learning goals of the attitude and motor skills categories (see further, section 16.5.2).

In the next section (16.3), the application of Gagné's teaching functions to (pure) correspondence education refers *generally* to the three cognitive domains of learning, and, *with the reservations now mentioned*, also to attitudes and motor skills.

16.3 The instructional events in correspondence teaching

In this section, some material from BÅÅTH (1974), LAMPIKOSKI & MANTERE (1976), *Aufgaben im Rahmen von Lehrfunktionen im Fernunterricht* (1977), and *Veiledning for brevskolelærere* (1977) has been utilized. The possibility of providing each of the teaching functions (instructional events) by means of (a) the teaching material, (b) the efforts of the correspondence tutor will be investigated.

(1) **Activating motivation.** Since correspondence learners often study alone, the beginning of the course – in particular – can be considered critical: there is no one at hand to »set the students going». (Cf. section 6.2!) It appears therefore advisable to try to activate the students' motivation particularly at the beginning of a course.

In the *teaching material*, motivation could to some extent be stimulated by such extraneous features as attractive layout and typography. Especially at the start of a course, details such as the attractiveness of the cover and the overall lucidity of the study material may be of importance. However, cultural factors are, no doubt, operative here. In a society where people are used to lavishly designed printed matters, the extraneous attractiveness of the material would be a more essential feature of a correspondence course than in other societies lacking this cultural condition.

With verbal means – in the text and/or on an audio tape – the course writer (and the editor) can try to activate the students' motivation, e.g., by

- describing what the knowledge offered through the course can be used for, what benefit, pleasure etc. the student could get from it (cf. GAGNÉ, 1977, p. 285)
- selecting such background information, examples, exercises etc. that might link up with the interests of the target group
- trying to arouse the students' curiosity
- appealing to the students' »motivation of task mastery and achievement (GAGNÉ, 1977, p. 288), by means of learning tasks offering moderately great challenges.

If the teaching material (including the assignments of submission) is capably designed, this will help the student to assimilate the material and, thereby, to experience enhanced competence. In turn, this success activates the student's motivation to master a still larger field of knowledge (skills, etc.), to widen his competence further (GAGNÉ, 1977, pp. 290–291). Thus, according to this view, the motivational task of the course writer and editor is, in part, a func-

tion of the total task to arrange favourable external learning conditions – all of the events of instruction. In other words: Good teaching activates the students' motivation. (Cf. the view of Ausubel, section 7.2.4!)

Correspondence students can, however, have difficulty in maintaining their motivation, no matter how well-designed the teaching material is. The course writer (and editor) can just address themselves to the *student in general*, appeal to the assumed interests, probable level of motivation etc, of a target group, and try to devise the study material so as to match what is known, or believed to be known, of the student group in general.

Therefore, the *correspondence tutor* seems to have an important task in approaching *each student as an individual.* In order not to run the risk of loosing the student already at the start of the course, the initiative to the contact should probably be taken by the tutor. He could, e.g., shortly after the student has applied for the course, write to the student, introduce himself and encourage the student in turn to describe his background, his interests, his aim in taking the course, etc. With the aid of such information about the student – and what will appear in the correspondence with him later on – the tutor could try to link up with the student's individual needs and interests and, on the whole, adapt his tutoring to what seems to be appropriate to this particular student.

It was assumed in another context that the most essential task of the correspondence tutor is to further the students' motivation (BÅÅTH & WÄNGDAHL, 1976). In addition to what has already been mentioned here, the tutor has at his command special means to help the student experience success and increased competence. He can provide the student with *individually* devised feedback. In doing so, he should probably try fairly often to encourage his students, since it may be difficult for those studying alone to assess their own achievements, which, in turn, may entail that they feel unsure of their capacity. It is obviously of particular importance to encourage students whose achievements do clearly not come up to either the demands of the course or their own purpose of taking the course. By pointing out what is actually good or at least acceptable in the student's solutions, offering praise – and, in addition showing how the student could improve further – the correspondence tutor can try to strengthen such a student's motivation.

In order that the tutor will be able to fulfil his motivational function, the *postal contacts* between student and tutor must probably be *fairly dense.* As a rule, these contacts have their point of departure in the student's assignment work. If the assignment occasions are sparsely dispersed in a course (and, consequently, each study unit comprehensive), the contacts between student and tutor tend to be few and far between. Most probably, this makes it very difficult for the tutor to activate the students' motivation.

Moreover, short study units provide the correspondence student with the opportunity to attain learning subgoals (embodied in the assignment questions) in a comparatively short time. The satisfaction obtained in this way is, very likely, motivating in itself (cf. BÅÅTH, 1976b, p. 38, function A).

(2) **Informing learner of the objective.** In the *teaching material*, the objective of each learning task should be stated as concretely as possible. If an audio tape is included in the course material, it would be advisable to present the objectives also on that – or, possibly, only on the tape. Moreover, the assignments for submission can be designed so as to directly exemplify the objectives.

In this connection, the *correspondence tutor's* task should be to refer to the goals/objectives and, in doing so, to take the student's individual purpose of studying into consideration (*Veiledning for brevskolekerere*, 1977).

(3) **Directing attention.** In the *teaching material*, the *generally alerting* function can be provided by attempts at variation and even some element of surprise by means of

- contrasts in typography and layout (e.g. by capitals, italics or bold-face print; framed, screened or coloured text passages; illustrations of various kinds)
- surprising or particularly interesting details of content – cometimes in the form of direct, maybe even somewhat provocative questions.

The student's *selective perception* of learning-relevant information can be facilitated by similar kinds of measures, and, in addition, by explicit instructions. Instructions and questions aimed at directing attention could very well be given on an audio tape accompanying the printed text.

As regards this function, the task of the *correspondence tutor* would primarily consist in trying to direct the student's attention to details which he has apparently overlooked.

(4) **Stimulating recall of relevant prerequisites.** All prospective students should get a fairly clear idea – by means of the study handbook, separate course descriptions, etc. (cf. function 2!) – of what previous knowledge is required by the courses. In addition, it would most likely be of considerable value to offer all students an optional test of previous knowledge. Especially in skill-oriented subjects, such tests would present a safer basis for the student's choice of starting level than could be obtained by means of an estimation based on the course description and the student's idea of himself.

In the *teaching material* proper, the course writer (+ editor) can in various ways promote the student's recall of relevant prerequisites. *Recognition* of what has been previously dealt with can be stimulated through

- *explicit* reminders (e.g., »As you may well remember, in study unit 3 you learnt that . . .«)
- short recapitulations of the *implicit* repetition kind.

True *recall* of essential previous knowledge can be stimulated by means of, e.g.,

- a short diagnostic test at the beginning of each study unit or chapter
- references to preceding parts of the course material
- single questions or exercises, inserted into the informative text.

The *correspondence tutor* may need to stimulate recall of relevant prerequisites in two types of situations:

1 when explaining a question which the student has failed to answer correctly
2 when replying to a question from a student.

In both cases, the tutor could make use of largely the same means as the course writer/editor: explicit reminders, implicit recapitulations, references to preceding parts, and – to some extent – inserted questions or exercises.

If the tutor has had an opportunity to get to know a student – through the student's result on a test of previous knowledge and/or his introduction of himself at the beginning of the course, as well as through the following correspondence – he would be able to link up with the student's individual previous knowledge and specific experiences.

(5) **Providing learning guidance**. This teaching function, which – according to Gagné – is aimed at giving direct help with the coding of the learning material, can also be provided for by means of such media for stored information that can be used in correspondence education.

In the *teaching material*, one could, e.g.,

- present the wider context where the new learning material fits in meaningfully, or
- show how subordinated component skills could be combined into the new rule which should be learned;
- arrange the learning material in such a way that its internal structure is evident, e.g., by using illustrations;
- provide explanations in the form of explicit comments, or
- guide the student by means of questions/exercises which carry the discussion forward.

Since the teacher – in this case the course writer/editor – has no face-to-face contact with his students at the time of teaching, he cannot obtain immediate feedback on his teaching. Consequently, an obscure statement, a link omitted from the train of thought, an inadequately prepared diagram, etc. cannot be immediately clarified in response to the students' reaction. The teaching material must therefore be most carefully planned. This applies particularly to the guidance function. The course writer (with the assistance of the editor) must try to *anticipate* which parts could present the students with difficulties, remove obscurities and provide answers to such questions that could be put by the students when confronted with the learning task. A *trial run* with a preliminary version of the teaching material could of course furnish valuable indications as to obscure and otherwise difficult parts.

(6) **Enhancing retention**. *Spaced reviews* to facilitate retention and retrieval of the learned matter can be provided in subsequent chapters and/or study units in the teaching material. There are various possible ways in which this can be done (cf. function 4). The course writer/editor can, e.g.,

- provide exercises/questions that require the student to recall what has been learnt previously
- explicitly repeat the essential elements of previous parts
- make use of »immanent reviews« (implicit repetitions).

Cues for retrieval (GAGNE, 1977, p. 296) can be provided by, largely, the same measures that are suitable for the fulfilment of function 5, providing learner guidance. It can, as a rule, be assumed that the better the student has managed to encode the learning-relevant information, the better will be both retention and recall from long-term memory. Therefore, a clear structure, explaining pictures and diagrams etc. are of great importance also in this connection.

In order to facilitate retention, the *correspondence tutor* can in a more individual-related way, e.g.,

- put questions, provide extra exercises/questions on the material already studied by the learner
- repeat essential points himself, with phrases better suited to the needs of the student in question than the presentation in the teaching material
- encourage the student to review relevant parts of the material.

As concerns cues for retrieval, the correspondence tutor can use the same means as the course writer/editor. (Cf. function 5!)

(7) **Promoting transfer of learning**. According to Gagné, positive transfer is facilitated, primarily, by

- varying examples (including comments on parallels, similarities, etc.)
- varying exercises and application questions.

Assimilating measures of this kind within the framework of the *teaching material* would hardly cause any great difficulties. The assignments for submission could very well be used for application questions aimed at enhancing transfer of learning.

The *correspondence tutor* can contribute to the fulfilment of this function, e.g., by

- providing concrete exemples, adapted to the individual student
- linking up with topics of current interest
- giving individual suggestions for practical applications of the newly acquired knowledge.

(8a) **Elicting performance**. In the *teaching material*, this function can be fulfilled by assignments for submission, as well as by self-check exercises, diagnostic self-tests, etc. If study units are extensive and, thus, the assignment occasions are comparatively rare – which is fairly common in correspondence education of today (BÅÅTH, 1976b) – the assignments for submission can hardly fulfil function 8a alone. (Cf. GAGNÉ, 1977, p. 297, and 15.3.2.) In such cases, self-check exercises and/or diagnostic self-tests must – to a considerable extent – be utilized for this purpose.

The *correspondence tutor* may offer the student new assignments if he has failed to solve the original ones. Otherwise, function 8a is hardly a task for the correspondence tutor.

(8b) **Providing feedback**. Quite different of course is the case with »event» 8b, which is traditionally considered as a primary task of the *correspondence tutor* (BÅÅTH, 1976b, p. 38). The problem is, however, that the feedback to the students' answers to assignment questions cannot be obtained immediately but is delayed by postage factors etc., as a rule one week or more (sometimes considerably more).

Therefore it appears advisable also to provide for the feedback function by means of model answers and comments to self-check exercises and/or diagnostic self-tests within the *teaching material*. The disadvantage of this form of feedback is of course that it can scarcely be so individually adapted as that which is provided by the tutor. Nevertheless, in those cases where the assign-

ments for submission are sparsely dispersed, model answers and comments to self-check exercises etc. constitute a valuable supplement to the feedback of the correspondence tutor.

16.4 Pure correspondence education in the light of Gagné's model: a summary

As we have seen in the preceding sections of this chapter, Gagné's teaching model is apparently well suited to being applied to correspondence education. Preparatory analyses and careful planning are natural in an educational form where a most considerable part of the teaching measures are »objectivated» (e.g., DOHMEN, 1970), i.e. transferred to a medium for stored information – the correspondence course material, in this case.

Certainly, *pure* correspondence teaching appears in many cases difficult to use for attitude learning, as well as for learning of motor skills. However, with regard to all types of cognitive goals – verbal information, intellectual skills, and cognitive strategies – the teaching functions dealt with by Gagné can obviously be fulfilled through (pure) correspondence instruction.

As far as these cognitive learning domains are concerned, the *teaching material* alone can – to some extent – fulfil all teaching functions. Gagné remarks:

> Assuming that the student possesses the necessary prerequisite skills, instruction by means of a book is usually a remarkably rapid and efficient process. (GAGNÉ, 1977, p. 306)

However, even if a book *can* be an excellent instructional tool, its inherent possibilities are seldom completely utilized:

> Textbooks, after all, are not always written in terms of properly supporting the processes involved in each learning phase. For example, does the printed text introducing a topic direct attention to the proper stimuli? Does it inform the learner of the nature of the performance expected from learning? Does it supply, or suggest, useful schemes for encoding? Does it require the learner to exhibit what has been learned, and provide corrective feedback for his performance? (GAGNÉ, 1977, p. 306)

The teaching material in correspondence courses is, in the ideal case, devised so as to support »the processes involved in each learning phase». Moreover, the division of the course material into study units, each concluded by an assignment for submission, can strengthen the students' motivation in that the assignments function as *sub-goals*, as steps on the path to the terminal goal of the course (cf. BÅÅTH, 1976b, p. 38, function A). In addition, by means of the *two-way communication*, which as a rule is centered around the very assignments for submission, the correspondence tutor can try to provide *individually* adapted help to all of the learning processes. In doing so, giving further support to the students' motivation would stand out as the tutor's most essential task (BÅÅTH & WÅNGDAHL, 1976).

However, reality never corresponds to an ideal, and the reality of correspondence education is no exception. Sometimes, the teaching material is not worked out in such a way that it fulfils all instructional functions in a way,

appropriate to the target group. In several cases, the two-way communication has its starting-point in sparsely dispersed assignments for submission (BÅÅTH, 1976 b), and the correspondence tutors do not always take pains either to provide individually adapted help or to support the students' motivation (BÅÅTH & WÅNGDAHL, 1976). Hard economic frame factors might play an important – sometimes even a crucial – role in all of these cases.

If a correspondence school does not place particular attention on the two-way communication, this deficiency can – in relation to highly motivated student groups – be compensated for by means of especially well-designed teaching material. On the other hand, course material which only partly fulfils the instructional functions can be compensated by means of intense efforts by the correspondence tutor. According to an observation by KEMPFER (1973) private correspondence schools – at least in the US – appear to lay the greatest emphasis on the design of the teaching material. By way of contrast, the »independent study departments» of American universities (which often have considerably smaller student groups and normally find it easier to obtain allowances for teachers' salaries than for production of instructional material) tend to attach the greatest importance to the two-way communication in correspondence education.

16.5 Postal two-way communication supplemented by simultaneous contacts

Provided that economic and organizational resources are available, the correspondence teaching institution should consider the need – if any – of supplementing the postal two-way communication by simultaneous contacts.

The need of simultaneous contacts of various kinds depends on a number of factors, above all

(1) the learning goals
(2) the students: their initial motivation, personality, previous knowledge, previous study experience, etc., as well as their living situation (dwelling, work, family conditions, etc.)
(3) the quality of the correspondence teaching.

In practical terms, certain kinds of *goals* or learning domains appear practically to demand simultaneous contacts, if the arrangement of critical learning conditions is not to be left to the students themselves. With regard to other kinds of goals, simultaneous contacts can be more or less desirable. (See further, section 16.5.1.)

Certain *students* obviously prefer correspondence education – that is, pure correspondence teaching – to correspondence study supplemented by face-to-face contacts (WÅNGDAHL, 1977). To some of them, pure correspondence teaching might even be the ideal mode of studying. KUSTERMANN (1970) refers to »impassioned correspondence students» (ib., p. 102) and thinks that, to certain types of correspondence students, ». . . the isolation [is] the very advantage of correspondence education» (ib., p. 163). MÜLLER (1974) recommends that the participation in supplementing face-to-face contacts be voluntary. In addition to preferences due to students' personality factors etc.,

one could, as reason of non-compulsory face-to-face contacts, mention the correspondence students' living situation, which sometimes makes attendance at lessons, seminars, etc. very difficult or even impossible.

On the other hand, simultaneous contacts could be of immediate help to certain groups of students, e.g., those with moderate or weak initial motivation, and those with imperfect previous knowledge and/or little previous study experience.

If the *correspondence course* does not entirely match the demands on the subject matter content – e.g., if it is incomplete or not altogether up to date – and/or does not fulfil all teaching functions to a desirable extent, this may of course be a reason of supplementing the correspondence education in question with, primarily, face-to-face contacts. However, in this case it would appear more appropriate to improve the teaching material and/or the correspondence tutor's contributions than to extend the correspondence teaching by simultaneous contacts.

In the following sections, simultaneous contacts are dealt with first (16.5.1) in relation to the domains of learning or varieties of goals/learned capabilities distinguished by Gagné, and after that (16.5.2) with reference to Gagné's different teaching functions.

16.5.1 The need of simultaneous contacts related to goals or domains of learning

The teaching functions are of varying critical importance within different learning domains and can to a varying degree be provided for in pure correspondence education. (Cf. 15.3.3 and 16.2.)

Teaching aimed at goals of the **verbal information** type would not, to any considerable extent, need to be facilitated by means of simultaneous contacts. Nevertheless, *telephone tutoring* and *individual face-to-face sessions* as well as *group meetings* might help students with imperfect previous knowledge and/or little study experience to attend to essential details.

Teaching of **intellectual skills** is probably – to a higher degree than is the case with other cognitive domains of learning – facilitated by a more or less programmed curriculum. Therefore, *computer-assisted distance education on line* could be used for complete instructional sequences within the intellectual skills area. For individual help *telephone tutoring* appears extremely well suited in this context, although face-to-face contacts can, of course, serve the same purpose.

For learning of **cognitive strategies**, *group meetings* – above all – could constitute a good supplement (cf. section 12.3.2 in the Bruner application chapter). Particularly at the beginning of the course, tutor-guided group meetings would be an excellent aid to introducing the students into the actual study form. – Also *individual guidance*, by telephone or in the form of face-to-face sessions, could naturally be used for the same purpose.

Attitudes, especially social attitudes, are probably best affected by a combination of correspondence teaching and *group meetings* which make social training through performance with feedback possible. However, in order to link up with students' previous experiences of success or to enhance modeling,

individual face-to-face sessions – or possibly telephone tutoring – would of course provide greater possibilities.

Integrated *face-to-face contacts* are almost necessary with regard to certain **motor skills**, considering above all the extremely important performance and feedback events.

16.5.2 The need for simultaneous contacts related to teaching functions

Within the cognitive learning domains, telephone contacts of the **individual telephone tutoring** kind appear to be useful in particular with reference to the following instructional functions (cf. AHLM, 1972):

- activating motivation (no. 1)
- directing attention (no. 3)
- stimulating recall of relevant prerequisites (no. 4)
- providing learning guidance (no. 5)
- providing feedback (no. 8b)

As we have previously seen (p. 99), one of the most essential tasks of the correspondence tutor might be to further the students' *motivation* and, thereby, to approach each student as an individual. It might however be difficult to fulfil this function if tutor and student have no other communication medium than the written word. Therefore, individual telephone contacts would provide an excellent aid in this respect.

Directing students' *attention* to essential and maybe overlooked details would probably also be easier during an oral discussion on the telephone than by means of the postal contacts.

Something similar is applicable to the promoting of students' *»recall of relevant prerequisites»*. In order to meet all individual demands of stimulating relevant previously acquired capabilities, a dialogue between student and tutor is probably necessary, in which the student is allowed to ask questions and have them answered. »Such a dialogue *could* be written, of course, but it is naturally much quicker and much more practical to have an oral one» (AHLM, 1972, p. 51).

For help with individual difficulties – not anticipated in the teaching material – confronting the student, two-way communication is needed. In this respect, the correspondence tutor has an important task when commenting on solutions of assignments for submission. In certain cases, such »remedial» *guidance* might be easier to provide during a conversation over the telephone after the solutions have been returned to the student. It would however be of great value to be able to provide help, e.g., in the form of answers to the student's questions, even *before* he has sent in his answers. Certainly, »prophylactic» guidance of this kind could be given by post. It is, however, better suited to simultaneous communication, e.g. telephone tutoring (AHLM, 1972, p. 51).

A disadvantage of the *feedback* that can be provided with the aid of postal two-way communication, is the inevitable delay between performance and feedback. Therefore, a good deal of feedback should be given already in the

teaching material, explicitly or implicitly. To fulfil this function entirely, telephone tutoring could be an excellent supplementary aid.

After a period of individual telephone tutoring, during which basic knowledge and skills have been mastered, **teletutoring of a number of students simultaneously** – by means of group telephone calls – could be utilized to promote *transfer*. (Cf. below concerning group meetings arranged for the same purpose!)

Telelecture with conference telephone for discussions following on the cable-born lecture – or lesson – could maybe have some *motivational* effect, perhaps also contribute to students' *transfer* of learning.

Individual face-to-face sessions – when they can be arranged – could most probably further *the same functions as individual teletutoring*.

The same applies to **group meetings** of various kinds (BÅÅTH, 1978). In order to fulfil the functions in question in the best way, such meetings supplementing correspondence instruction are likely to be of the »learner-controlled guidance» type, rather than designed as »teacher-controlled teaching» (FLINCK, 1975b).

In addition, a most valuable task of group meetings could be to promote *transfer*. However, according to Gagné, a fundamentally essential requirement is that those basic facts and skills presupposed in a discussion are already well learned:

> Ideally, the class discussion is an excellent way to promote transfer of learning. When members of a discussion group have available to them a common set of information and skills, they are able to display their originality of thought in a setting which provides valuable feedback from other members of the group. In such situations, reinforcement is provided for originality of thought, critical judgement, and facility to communicate ideas. . . . The ideal, however, is not achieved very frequently. In fact, the most frequent occurrence in discussion groups is the interjection of questions or comments which clearly indicate the absence of prerequisite knowledge and skills on the part of individual members. (GAGNÉ, 1975, p. 129)

A practical consequence with regard to group meetings combined with correspondence education would be that meetings including discussions aimed at promoting transfer should at least not be arranged until all of the group members have worked through the study unit(s) in question and have got their solutions to the attached assignments for submission returned.

Computer-assisted distance education on line appears useful primarily with reference to the two teaching functions *eliciting performance* and *providing feedback*. In particular, the immediate feedback provided when in direct communication with a computer should be an advantage.

16.6 Gagné's model applied to correspondence education – a summary review

Gagné's teaching model is applicable to written instruction, as well as to other forms of teaching. The model allows the emphasis of correspondence education directed to cognitive goals to be placed on the *teaching material*. Never-

theless, the generality of the model makes various applications possible. When applying the Gagné model, even ideas from mild control teaching models (e.g., Bruner's) and non-control models (as Rogers) may be incorporated.

To a greater or less extent, all of the teaching functions directed towards cognitive goals can be fulfilled through the *postal two-way communication*. Provided that the teaching material is well designed from a didactic point of view, the correspondence tutor's primary task must be to provide *individual* help with reference to all instructional functions – as far as this is possible.

As regards learning of certain *attitudes* and *motor skills*, pure correspondence education is hardly sufficient. When teaching towards goals within these categories, integrated *face-to-face contacts* appear particularly well suited.

For individual aid in courses with primarily *cognitive* goals, both *telephone tutoring* and *face-to-face contacts* can be used. This would, above all, apply to those teaching functions related to motivation, attention, previous knowledge, guidance, and feedback. In addition, group meetings are a potentially excellent means of promoting transfer.

Computer-assisted distance education on line seems to be applicable particularly to instruction aimed at developing *intellectual skills*. As regards the remaining categories of cognitive goals, this form of simultaneous contacts could be especially well suited to the performance and feedback phases of the instructional sequence.

17 Summary discussion

The aim of this study was to try to shed light on correspondence education with the aid of a number of contemporary teaching models. Only models related to psychological theories of learning or personality were chosen for the study, which is a conscious limitation of its scope. It was required of the models that they should (preferably) be well-known, that they ought to represent fairly different contemporary views on teaching, and that not only models with seemingly obvious application to correspondence education should be chosen.

To be precise, the purpose of this study was to contribute to a deeper understanding of both what correspondence education *is* and how it *could be developed*, starting from the various teaching models.

In the following, a general summary is first provided (17.1), stating what the analysis has displayed concerning, on one hand, the applicability to traditional correspondence education of the models chosen and, on the other hand, their emphasis on the teaching material or on the two-way communication. In a particular section (17.2) there is a discussion of the factors that should be given general consideration when choosing and applying a model. There follows a section (17.3), where the functions of postal two-way communication are treated separately, in the light of the various models. In this connection (17.4), the need for supplementing simultaneous contacts is also discussed more in detail, as well as the functions that such contacts could fulfil.

17.1 The possibility of applying the models to correspondence education

All of the models chosen – Skinner's, Rothkopf's, Ausubel's, Egan's, Bruner's, Rogers, and Gagné's – were found applicable to pure correspondence teaching. However, the models appeared to vary in the extent to which they could be applied naturally and smoothly. This is, among other things, related to the views of the *goals* that teaching/learning should have and of how strictly *controlled* the students' work towards these goals ought to be. **The stricter the control towards fixed goals, the easier apparently is the application of the model to correspondence education.**

With some simplification, it would therefore be possible to arrange all of the models except Gagné's – starting with Skinner's and ending with Rogers – on a sliding scale, with regard to the ease with which they can be applied to pure correspondence education. (Cf. *box 1*, 2.2!) Skinner's and Rothkopf's models seem to be easiest to use, but neither Ausubel's or Egan's raise any fundamental problems. Bruner's model demands more of student-initiated activities and dialogue, and is therefore more difficult to apply to pure correspondence education. In Rogers model, the initiative is entirely with the student

himself. Here, (possibilities of) supplementing simultaneous contacts by telephone or face-to-face appear more justified than in any of the other models.

Models with stricter control towards fixed goals also imply, when applied to correspondence teaching, a greater emphasis on the *teaching material* than on two-way communication. *Table 4* provides a survey of the six models mentioned as regards their orientation, when applied to correspondence education, toward teaching material or two-way communication. The same table also gives an indication of the possibility of applying the various models to pure correspondence teaching (the column »Desirability of telephone or face-to-face contacts»).

*Table 4. The orientation towards teaching material versus two-way communication implied by the six first models, when applied to correspondence education, as well as the desirability of supplementing telephone or face-to-face contacts. (*** = great emphasis on/great need of; ** = moderate emphasis on/moderate need of; * = little emphasis on/little need of)*

Teaching models	Emphasis on		Desirability of telephone or face-to-face contacts
	teaching material	two-way communication	
Skinner's	***	*	1)
Rothkopf's	***	*	*
Ausubel's	***	*	*
Egan's	**	**	*
Bruner's	**	**	**
Rogers	*	***	***

1) Hardly any need at all with regard to *cognitive* learning goals. (Face-to-face contacts may however be necessary as concerns, e.g., certain kinds of *motor skills* goals.)

In Gagné's model emphasis is given to a new variable, which is relevant to the possibility of using pure correspondence education: the *type of learning goals* or domains of learning. Pure correspondence education seems to be well adapted to teaching that is directed towards cognitive goals of the verbal information or intellectual skills type. This also largely applies to goals of the cognitive strategies type. Learning of (certain kinds of) attitudes and motor skills appear however to require a higher degree of face-to-face contacts, in the first place. See *table 5*!

Table 5. Desirability of supplementing telephone or face-to-face contacts in teaching towards various types of goals according to Gagné's taxonomy. (For a key to the signs, see table 4!)

Goals	Desirability of telephone or face-to-face contacts
Verbal information	*
Intellectual skills	*
Cognitive strategies	**
Attitudes	***
Motor skills	***

Let us examine the relation between *tables 4 and 5*! Skinner's, Rothkopf's, Ausubel's and Egan's models are primarily concentrated on goals of the verbal information and intellectual skills type. The need for oral simultaneous contacts implied by these models is consequently limited or – as regards the Skinner model – almost non-existent.

Skinner's model might, however, be better adapted to learning of motor skills. For certain kinds of such goals face-to-face contacts with demonstrations and immediate feedback on performance appear desirable.

Bruner's model is primarily concentrated on cognitive strategies. Accordingly, this model implies a greater need for telephone or face-to-face contacts.

Rogers model is intended to be applicable to all varieties of goals or learning domains. Nevertheless, Rogers lays great stress upon the attitudinal side of all learning. This is very well in accordance with the considerable need for supplementing telephone or face-to-face contacts, that is clearly implied by his model.

17.2 Which factors should be considered when choosing and applying the models?

The **choice of model** should be dependent on, primarily,

- one's *basic view of learning* (and, with that, maybe also one's basic view of man)
- the *variety/varieties of goals* of the teaching planned.

However, knowledge of the *students* – their personality structure, cognitive aptitudes etc., as well as their preferences with regard to studying – could also be considered when choosing a teaching model. E.g., a model implying strict control would not appear particularly well adapted for highly autonomous students (cf. MOORE, 1973, 1975, 1977).

In addition, the following three factors might be considered:

- economic frames
- access to cooperation partners (e.g., to arrange face-to-face contacts)
- access to course-writers and tutors, fitted to work in accordance with a certain model.

Probably, factors like these could, to an even higher degree, affect the **practical application of the models**. For instance, the economic frames of most institutions do – so far – not permit use of computer-assisted distance education on line as a supplement to correspondence education. For the same reason, systematic telephone tutoring may in certain cases be practically out of question. The possibility of integrating face-to-face contacts into correspondence teaching may be rendered difficult by economic frames as well as by lack of suitable co-operation partners.

As was the case with the choice of a model, when applying a chosen model one should consider what is known – or can be assumed – about the *students* of the planned course. Most likely, persons with little study experience have a greater need for fairly dense two-way communication than those being more experienced. Extrovert individuals probably feel a greater need for simultaneous

contacts, in the form of telephone or face-to-face teaching, than introvert ones. In addition, a considerable number of prospective students are practically prevented – by job or family conditions or by a physical handicap – from participating in oral lessons or other types of face-to-face meetings. Others have no telephone.

From what has now been stated, it follows

- that it would often be justified to make *telephone and face-to-face contacts* supplementing correspondence education *optional* (cf., e.g., MÜLLER, 1974; PLICKAT, 1978);
- that correspondence schools should consider *developing the* **postal** *two-way communication* according to the demands implied by the teaching model(s) they want to apply.

In the following section, a closer study is made of these demands on the assignments for submission and, above all, on the work of the correspondence tutor.

17.3 Which are the possible functions of postal two-way communication?

In correspondence teaching by means of pre-produced instructional material, it is, as a rule, the graphic medium – i.e., text and illustrations – that is mainly used. Representatives of correspondence teaching often emphasize the great didactic potentials of printed material (e.g., PETERS, 1971a, 1977, ERDOS, 1978). With the exception of Bruner's and Rogers models, many of the basic demands made on teaching by the models dealt with in this study can only be met by means of carefully devised teaching material. Nevertheless, our analysis has indicated essential functions of the postal two-way communication, in the light of each of the teaching models.

17.3.1 Particularly important functions

According to **Skinner's** model, the main task of the correspondence tutor would be to check the student's achievements. However, certain other tasks are also discernible. All of them have an *individualizing* purpose, e.g., to assess the student's appropriate starting-level, to consider – if possible – his specific abilities, previous reinforcement patterns, etc. The assessment of achievement should also be performed as formative evaluation, i.e., evaluation aimed at promoting the individual student's learning.

Nor does **Rothkopf's** model imply many tasks for the tutor. Nevertheless, we found at least one function which hardly can be fulfilled solely by the teaching material: to influence the students' class 1 and 2 MGA – i.e., helping them to get started on their studies, when everything seems difficult and the spontaneous desire to study is insufficient to overcome external obstacles. This type of influence will probably be more efficiently handled by an *individually* adapted approach.

In addition, the correspondence tutor should provide a degree of support in the form of *individually* devised directions and questions in order to influence the students' class 3 MGA.

An essential tutor task according to **Ausubel's** model would be to determine each student's *individual* previous knowledge and cognitive structure at the beginning of the studies. If necessary, the student should then – before the start of the actual course – receive help with acquiring such knowledge that can guarantee a good start to the course. Otherwise, when applying this model the correspondence tutor's major task seems to consist of providing guidance and feedback in connection with achievement checks that are mainly aimed at consolidating the learned material and promoting positive transfer to subsequent parts of the course.

According to **Egan's** model for structural communication, the primary task of the tutor would be, either to give *individually* devised discussion comments, or to answer students' questions (»reverse» assignments for submission). This should naturally also be done in a manner that promotes individualization.

When trying to apply **Bruner's** teaching model, the tutor's most important tasks would be to provide *individually* adapted help with the purpose of facilitating full insight. In addition, the correspondence tutor should stimulate independent thought and the student's own discovery of knowledge.

Rogers model would imply the following primary tasks for the correspondence tutor:

- to check »open» assignments for submission and/or to answer »reverse» assignment questions
- to do this as part of a *dialogue* with each individual student, a dialogue characterized by realness, positive valuing of each student, and empathy.

The tutor would, finally, have more or less important tasks in relation to each of **Gagné's** teaching functions – with the possible exception of (8a), eliciting performance. The tasks of the correspondence tutor appear particularly important in connection with the following »instructional events»:

(1) activating motivation
(4) stimulating recall of relevant prerequisites
(5) providing learner guidance
(8b) providing feedback.

In all of these cases it is essential that the correspondence tutor provides individual help. In order to activate a particular student's motivation as efficiently as possible, the tutor should link up with his *individual* expectations and offer individually adapted support (encouragement, praise, etc.). The tutor should, furthermore, try to find out the student's *individual* previous knowledge and experiences, in order to be able to work out his *individualized* guidance and feedback to the student.

17.3.2 What is required in order that the correspondence tutor shall be able to fulfil the functions implied by the models?

Even in traditional correspondence education, tutors are expected to fulfil some of the functions discussed in the previous section. This applies, above all, to

functions like feedback, guidance and motivation – all of them requiring individualized tutor comments.

However, most of the teaching functions dealt with make considerably greater demands on correspondence tutors and schools.

First of all, practically all models would require *measures to enable correspondence tutor and students to get to know each other.* Some correspondence teaching institutions, e.g., Danmarks Brevskole, have actually introduced such possibilities in their regular practices. As a rule, however, tutor and students in correspondence education seem to be almost anonymous to each other, the exceptions depending more on the individual student's and tutor's initiative than on measures on the part of the correspondence school.

Generally, it would appear desirable both that the tutor introduces himself (in a manner as personal as possible, according to Rogers model), and that the student – e.g., by answering one or more questions at the first assignment occasion or already at the start of the course – gets an opportunity to describe his objectives in taking the course, his interests, his work, his previous education, etc. The very first contact ought to be taken by the tutor.

In connection with this introduction of the student, a *test of previous knowledge* could be given. Such a test seems to be desirable not least when applying Ausubel's model. At certain correspondence schools tests of previous knowledge are already given, mainly in foreign languages and mathematics. As a rule, these tests are optional.

To be able to fulfil the tasks indicated by each of the different models, the correspondence tutor would – in most cases – need *comparatively frequent contacts* with the students. At certain correspondence schools the submission density is actually high, but at a considerable number of them this requirement is apparently not met at the present time (BÅÅTH, 1976b).

In addition, Egan's and Rogers models imply *types of assignment questions* hitherto used only to a fairly limited extent. The commenting on and answering of such »open» and »reverse» assignments would probably be more stimulating to the tutor than the traditional marking of answers to fixed questions – but also much more demanding.

17.3.3 The computer as an aid to the correspondence tutor

The tutor functions indicated in the preceding sections are doubtless rather demanding. *In addition to* devoting himself to the traditional, and apparently self-evident, tasks of checking students' solutions and, in doing so, correcting and commenting on wrong answers and misconceptions in partially correct answers, the tutors – according to most of the model analyses – would have to commit themselves to the students as individuals, link up with individual previous knowledge and interests, maybe help them to get started, discuss student-initiated questions, etc.

Although correspondence education of this or a similar kind actually exists (see, e.g., GRUENBAUM, 1959; EIFERT, 1978) and has been recommended by representatives of this teaching form since the last decades of the nineteenth century (BÅÅTH & WÅNGDAHL, 1976) – for the time being, it is an exception rather than the rule. It might in fact appear difficult to see how the economic frames, within which at least many private correspondence schools are

compelled to run their activities, could allow space for widened and deepend tutor efforts as indicated here.

In this situation, the utilization of *computer-assisted distance education off line* could provide valuable help to the tutors, at least to those working for larger correspondence teaching institutions. In all cases, where the learning goals make it possible, the assignments for submission could be designed as multiple-choice questions, in order to enable the answers to be processed and commented on by a computer which prints out full and – as far as possible – individualized commentary letters to each student. BÅÅTH & MÅNSSON (1977) have shown that computer-assisted correspondence tuition of this kind can work well, be highly appreciated by the students, and even be felt as personal.

As we have seen, cognitivistic psychologists such as Ausubel and Bruner have spoken particularly favourably of multiple-choice questions. (For a fuller discussion of the usefulness of multiple-choice questions, see e.g. BÅÅTH, 1976b.) The kind of problems used in programmes for structural communication is more complicated than ordinary multiple-choice questions but is nevertheless well suited for computer processing.

If the computer is allowed to take over, in the first place, all of the routine work in the two-way communication, it should be easier for the correspondence schools to let the tutors devote themselves to helping students with their individual learning problems and needs – and for the tutors themselves to *be able to* do this.

17.4 Important functions of integrated simultaneous contacts

No doubt, the demands implied by the various teaching models could in several cases be more easily and smoothly met by means of simultaneous contacts integrated with correspondence education than by pure postal two-way communication. As we have seen (*table 4*), this seems to apply particularly to personal simultaneous contacts in connection with Bruner's and Rogers models.

However, we have also found that consideration of individual students' circumstances and wishes may justify that such telephone and face-to-face contacts are allowed to be – to a great extent – optional (section 17.2).

17.4.1 Computer-assisted distance education on line

As seen when discussing the application of **Gagné's** model, the main advantages of integrating computer-assisted distance education on line apparently refer to the teaching functions »elicting performance» and »providing feedback». The particular attraction of this kind of computer-assisted instruction in connection with correspondence education is the possibility to provide not only *carefully planned* and *comparatively individualized* but also *immediate* feedback. Hardly any other medium can offer this.

When applying **Skinner's** model, these advantages indicate that even *all* of the teaching could be mediated by the computer – if this were economically feasible. An alternative, more realistic, way of utilization is to let the answers

to *assignments for submission* be processed and immediately commented on by the computer.

Also with regard to **Rothkopf's**, **Ausubel's** and, not least, **Egan's** models it would appear meaningful to let the computer – to a greater or less extent – take care of the *assignments for submission* and/or the *self-test exercises*, and (of course) the processing of the students' answers.

Another function, apparently well suited to a computer and implied by **Ausubel's** model – among others – is to analyze answers to *tests of previous knowledge* and to provide recommendations based on such analyses.

According to **Rogers** model, computer-assisted distance education on line could be a *resource* to use, e.g., in programmes for certain basic intellectual skills (using Gagné's terminology).

17.4.2 Telephone teaching

The greatest potential value of telephone contacts as a supplement to correspondence teaching seems to lie in the opportunities to establish *individual* and individualizing contacts between tutor and student provided by t e l e p h o n e t u t o r i n g. A considerable number of the demands on the tutor made in sections 17.3.1 and 17.3.2 would be more easily met by means of systematized telephone tutoring than by mere postal contacts.

Even when applying a model such as **Skinner's**, telephone tutoring could fulfil a certain function – to *help the tutor to get to know the individual student*. This knowledge should be used in the attempts of the tutor to arrange as appropriate reinforcement conditions as possible.

According to **Rothkopf's** model, telephone tutoring could – above all – help students to *get started* (class 1 and 2 MGA), but also stimulate their processing of the subject matter (class 3 MGA).

Also according to **Ausubel's** model, individual telephone contacts could apparently be of some use in the *starting phase* of a course. The main purpose of such contacts should be to facilitate the linking up of the first part of the course material with each student's individual previous knowledge and cognitive structure. Also with regard to the *later processing of the course material*, discussions by means of telephone tutoring could probably be valuable. In this case, the contacts should aim at furthering the student's comprehension, his integration of the new material into his specific cognitive structure.

In correspondence education along the lines of **Egan's** structural communication model, the telephone could – above all – be used for individual *discussions of the answer combinations* chosen by the student.

Bruner's model requires, among other things, something like a Socratic *dialogue when guiding the student in his work with discovery problems*. This tutor task could most probably be considerably facilitated by using the telephone as a distant communication medium supplementing the postal contacts.

Rogers model seems to provide rich possibilities for meaningful individual telephone contacts, with the purpose of *establishing a close relationship* between the student and the correspondence tutor, as well as of giving the student opportunities to *discuss his problems*, e.g., when choosing a »project» or similar tasks and during his work with these.

With regard to cognitive learning goals, *individual guidance* over the telephone would appear to be valuable as a medium for the fulfilment of the following **Gagné** teaching functions:

- activating motivation
- directing attention
- stimulating recall of relevant prerequisites
- providing learning guidance
- providing feedback.

The need for t e l e l e c t u r e s as a supplement to correspondence education appears to be rather limited, although the possibility of including discussions by means of conference telephone(s) undoubtedly increases the potential value of telelectures, particularly according to **Bruner's** and **Gagné's** models.

Telephone teaching of the d i a l - a c c e s s type would seem to be an excellent resource from – above all – the **Rogers** model point of view, since the students' own knowledge searching activities are so strongly emphasized by this model.

17.4.3 Face-to-face contacts

I n d i v i d u a l g u i d a n c e by means of face-to-face contacts can be assumed to fulfil, on the whole, the same functions as telephone tutoring. Such guidance is however often difficult to arrange within the framework of correspondence education – mainly for economical reasons.

»Face-to-face contacts» will in the remaining part of this section refer to g r o u p m e e t i n g s of various kinds. (It is of course possible to include personal talks between the group tutor/teacher and individual students as a part of the group meeting schedule. The distinction made here is between pure individual contacts on one hand, and meetings *primarily* planned for contacts between a tutor/teacher and a group.)

As previously mentioned, face-to-face contacts appear necessary for certain learning goals of the *attitude* and *motor skill* types, according to **Gagné's** division. Even in teaching towards cognitive learning goals, face-to-face contacts as a supplement to correspondence instruction can be of great importance for certain kinds of students. This refers not least to the teaching function *activating motivation.* Group discussions with well prepared participants can also be an excellent means of *promoting transfer.*

What has been stated in the preceeding section concerning telephone contacts in the light of **Rothkopf's** and **Ausubel's** models, most probably also applies to face-to-face contacts between tutor and student. Consequently, such contacts could be of importance not least in the *starting phase* of a course. On the whole, face-to-face meetings in the beginning of a course would likely be an effective means of *preventing non-start and early drop-out.*

The most sensible way of utilizing face-to-face contacts when applying **Egan's** model apparently is to concentrate them round the work on *problems + response matrix (matrices)* and the subsequent *discussions.*

An interesting similar way of applying **Bruner**'s model to an integration of correspondence and face-to-face teaching would be to advise the students to work with *discovery problems* during the group meetings.

The establishment of the *relationship between learner and »facilitator»* implied by **Rogers** model could no doubt be substantially facilitated by face-to-face contacts. In other respects, such meetings should – when applying this model – be utilized according to the *students'* own wishes.

18 Concluding remarks

Controlled experimental attempts at applying the models dealt with in this study to correspondence education would be most welcome. Practically no empirical studies of this or a similar kind have hitherto been carried out. A rare exception is an experiment reported by LDTC STAFF, LESOTHO (1977). For critical comments on this experimental study, see BÅÅTH & REKKEDAL (1978).

When empirically applying teaching models – in the form of development projects that are of immediate practical use or more scientifically controlled but nevertheless realistic experiments – one could very well try to *combine and/or modify various models* (cf. JOYCE & WEIL, 1972, p. 384; MATHIS & MC GAGHIE, 1974, p. 49–50), whenever this appears justified. Pedagogical phenomena are »man-made» – they do not yield to laws or other modes of invariance found in science (GOWIN, 1972). No doubt, we can therefore never find out *the* best method or *the* teaching model that is most appropriate in all contexts. Nevertheless, each of us can – to the best of our abilities – try out, experiment, search for what may be most suitable to his own particular teaching situation.

In this study, *correspondence education* has been throughout the starting-point of the applications to distance education – even when combinations with simultaneous contacts have been discussed. This limitation has been due to the necessity of concentrating on a limited number of problems. However, in practice a great many different varieties of combinations are possible: between forms of distance teaching, as well as between such forms on one hand and various kinds of face-to-face contacts on the other. The Open University in Britain represents a variant of distance education where correspondence teaching has a central position. In other cases of distance education on the post-secondary level, correspondence teaching plays a more subordinate role, and in certain systems of post-secondary distance teaching, no postal two-way communication is included at all (FLINCK, 1976a).

From other points of departure than those chosen for this study, one could most probably find that elements of correspondence instruction might be a *supplement* to other teaching forms – instead of vice versa – when applying the teaching models in question to distance education. An example of this could be radio and/or TV teaching, supplemented by the postal two-way communication which is the most distinctive feature of correspondence education.

It would of course even be possible to imagine an analysis of teaching models, with regard to distance education, which does not at all take correspondence instruction into consideration. This would however mean depriving oneself of the opportunity to utilize a normally economical and practical form of distance teaching – a form which, according to the findings of this study, can be used to attain several different types of learning goals described in teaching models with a considerable range of variation.

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